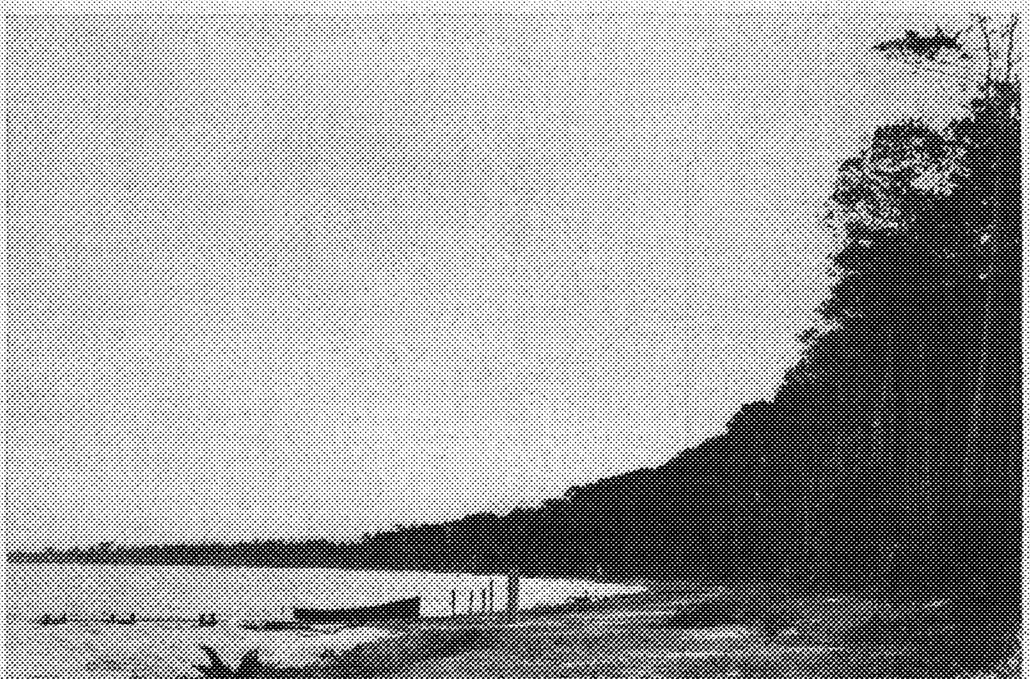
MINNESOTA TECHNO-LOG

VOL. IV. NO. 1

NOVEMBER 1923



PUBLISHED MONTHLY DURING THE SCHOOL YEAR BY THE STUDENTS OF THE COLLEGE OF ENGINEERING AND ARCHITECTURE AND THE SCHOOL OF CHEMISTRY. UNIVERSITY OF MINNESOTA

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

© O. E. CO

The Heckscher Building
New York City

WARREN & WETMORE
Architects

Architecture—Today and Tomorrow

THE great buildings of today, designed in masses which rear rugged, mounting profiles into the sky, foretell even greater and more massive structures for the next half century. Always a close co-ordination of architecture and engineering, of design and construction, the architecture of the future will find architect and engineer working ever more closely together.

Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

O T I S   E L E V A T O R   C O M P A N Y
Offices in all Principal Cities of the World

INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

Published and Copyrighted Monthly by

The Engineering Students
of the
University of Minnesota

Main Engineering Building, Minneapolis, Minn.

Subscription $1.50 per year — Twenty-five Cents the Copy

VOLUME IV — NOVEMBER, 1923 — NUMBER 1

TABLE OF CONTENTS

MINNESOTA TECHNO-LOG
University of Minnesota
VOLUME IV NOVEMBER, 1923 NUMBER 1

THE 1924 CIVIL CAMP

HO HUM---THAT CIVIL CAMP AGAIN

Cass Lake is Gradually Recovering From the Effects of the Annual "Snipe Hunt"

By A. R. McCrady

THE six weeks' summer camp is a required part of the civil engineering course. We are sent to camp to practice the art of surveying, the science of which we have studied during the previous two years. A considerable part of the time is spent on triangulation, stream measurement, running section lines, and other operations that cannot well be carried out in the vicinity of the campus. Some forty-five of us went to camp this summer. We mapped a few square miles of Cass County, shot Polaris, read triangulation and became more or less adept at running an instrument under field conditions.

The camp is situated at Norway Beach, a pretty piece of lake shore east of the town of Cass Lake. The surrounding country is part of a National Forest Reserve and is heavily wooded with Norway and other pine.

It was a good outing. We spent six weeks here, living an active, open air life that probably did us all good, more especially those whose previous experience as pioneers had not taken them further than the wilds of Como Park. There was lots of swimming, hiking, fishing and hunting. There was perhaps too little hunting and too much hiking to be just right, but the hunting season didn't open until a few days before we came back, whereas the hiking season opened the day we got there. No football practice was held but something very much like it occurred every day at supper time when mess call sounded. You know how camp life affects a man's appetite—and manners.

The day started at 5:30 A. M. and from then until supper time we were kept pretty busy with the day's assignments. If it rained, we had the day off but it so happened that it rained only at night, thus almost causing the boys to lose faith in the efficacy of prayer. After supper we were left to our own devices and generally some of the bunch went to town, four miles away. Too far away, according to our shieks who sometimes had to return to camp by foot after a hard night of shieking. And too close, according to Professor Cutler, who sometimes tried to get some work out of them on the following day.

This is the third year the engineers have camped at Cass Lake, so their coming is a sort of an event to be looked forward to by the Cass Lake people, like homecoming day at Minnesota or, better perhaps, like the annual epidemic of smallpox in Haiti. At any rate they know when we are coming and to a certain extent prepare for us, by padlocking their cellars and sending their daughters away for a long visit.

Cass Lake is a village of some sixteen hundred people, not counting Indians, of which there are a great many. Despite the difference in size, however, there is no essential difference between it and Minneapolis. Cass Lake has its movies, pool halls, parks, schools, bootleggers, holdups, automobile accidents and divorce scandals like any big town. But there was one thing dear to the heart of every engineer that was lacking. There was no Arcadia. The idea of living six weeks in a town without dances was too much for our track hounds to contemplate. So we called our musicians together, told them they were an orchestra, and put on a dance. Previous to this initial appearance, no two of the musicians had ever played together but that was no obstacle. So far as I could see, no two of them played together at the dance, but we called them the musicians and their output music and it must be said they got by big. As a social function the dance was a success, so we held them every now and then until camp broke up.

The entertainment at these dances was not entirely of the terpsichorean type. The camp boasted of several tried and true entertainers, who gave much entertainment at each session. Mr. McCrady gave forth his voice in song, he was ably supported by the famous baritone, George Guerin. Mr. Herb, alias "Shiek" Liese, our bass player, left the platform on several occasions to give the natives a treat by way of his clever foot work. Then there was our announcer, a man trained in the art of public speaking and with a powerful pair of lungs. He was no other than the famous Swedish comedian, Frank Theodore William Roos. Mr. Roos did the honors in a manner to make the best circus barker hide his head in despair. Due to the patronage of the boys at camp, two Indians, and the young ladies of Cass Lake, the gate usually paid expenses and enough over for a light lunch for the orchestra.

Those who didn't dance generally stayed in camp and put in the evening writing home or playing the national game. There is some dispute as to whether the national game is baseball or draw poker but the foregoing statement will hold whichever way the matter is decided.

While the spirit of the men was generally democratic, certain lines of cleavage manifested themselves early in the camp and became more pronounced as time went on. The most marked rivalry developed between members of Tau Beta Pi and the Plumb-Bobs, another honorary engineering fraternity having certain grades as a prerequisite to membership. Personally, I have observed both factions at work and it is my opinion that the Plumb Bob, when sober, does quite as good work as anybody.

There was one event that we will all remember. On the evening of August 16th fully half the personnel of the camp went by automobile to a point some five miles up the lake shore to hunt snipes. The snipe, let it be understood, is a crafty, elusive bird that is not to be caught by the ordinary devices of the hunter. The decoy and bait leaves him cold and indifferent. He is too timid to be stalked, too wary to be snared. He has but one weakness, viz., upon seeing a lighted lantern at night he immediately puts down his head, shuts his eyes, extends his wings and runs toward it. It is then an easy matter for the man with the lantern to hit him over the head with a stick, held in the right hand, and push him into an open bag, held in the left hand, thus making him captive. In hunting snipe this process is merely continued until the bag is filled. Other men, "beaters," so called, are assigned to beat up the brush, to rouse the snipe out of his lair and drive him toward the lantern; but their mission is a secondary one. The post of importance, the key position, is held by the man with the lantern.

On the night of the hunt, then, there were selected for the post of holding bag and lantern three reliable, sturdy men, Nyvall, Mark and Hiner; they were equipped each with a lantern, a stick and a bag and posted at three strategic points to await the onslaught of snipes, while the balance of the party plunged into the forest to scare up the game. At this point, gentle reader, I ask you to pause and contemplate this intrepid triumvirate amid this pastoral scene. There they stood, like Horatius and his two compatriots at the bridge, the lake on one side, the wilderness on the other, dauntlessly awaiting the charge of the snipe brigades, ready each with his trusty bludgeon to deal death and destruction to any and all snipes that ventured into his allotted area.

The expedition was brilliantly conceived and in the main well executed, but success was fated not to crown it. As the night wore on and no sounds broke the stillness of the air, it became increasingly apparent even to our trio of bagmen, that some detail of an otherwise perfect hunt had gone awry. At midnight one remarked that the avalanche of game should be arriving soon. At one o'clock they said there was something funny about this business. At two o'clock they threw their lanterns in the lake and grimly set out along the five-mile trail that led to camp. No game, no ride home. Only the plod-plod of weary feet, interrupted now and then by the hoarse cry of the tote-road shagamaw or the wail of the wampus cat.

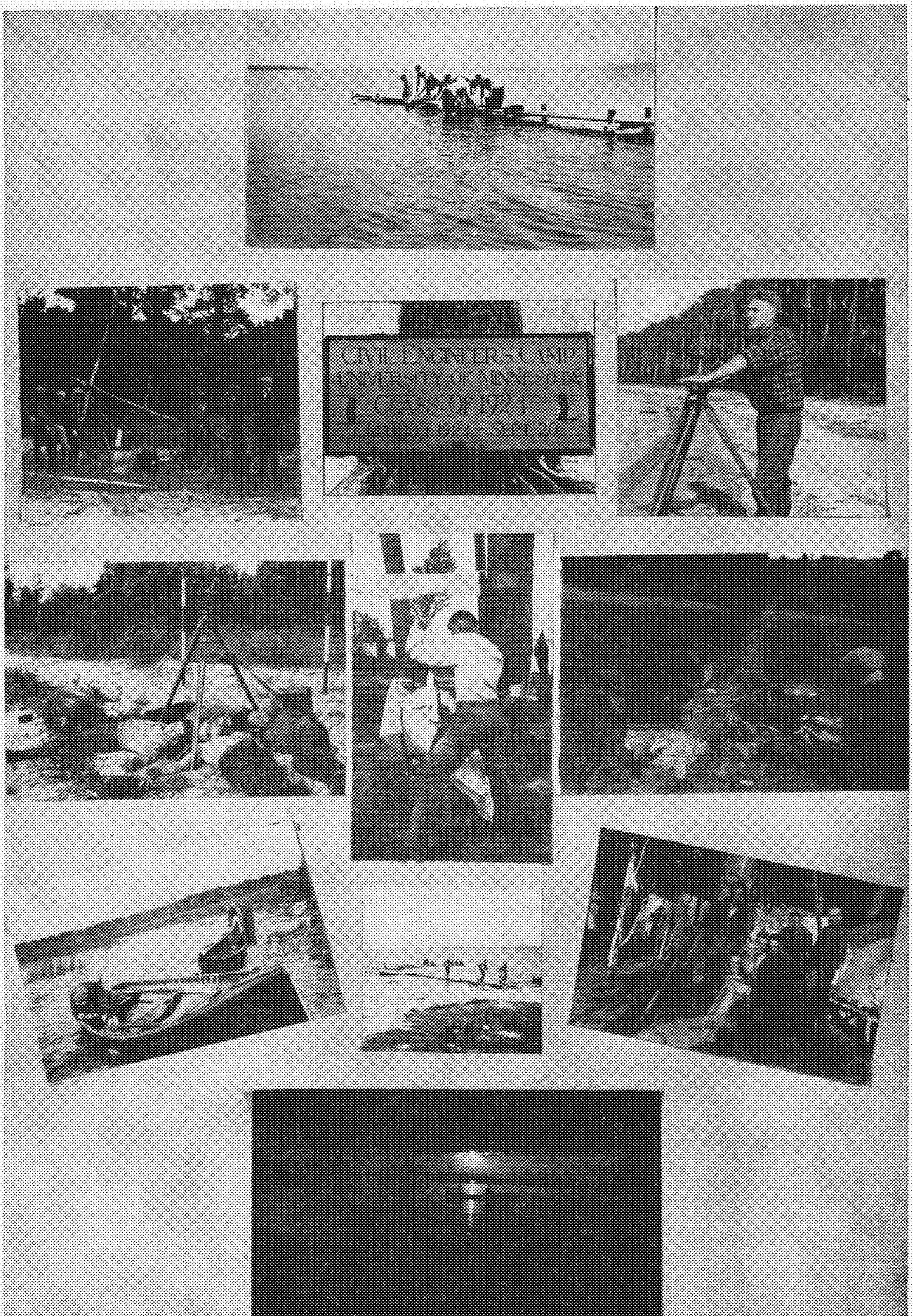
Of course we all get fooled some time or other. One party journeyed several miles across the lake to Squaw Island, only to find when they got there that there were no squaws on the island.

Various trips were taken during our stay in camp. Some were by automobile, some on foot, and again some by water. Of the last group, one of the longest and least profitable was executed one evening in the good ship "Ruff and Reddy." One young man while reading triangulation from Cedar island found a note pinned to the signal pole with a perfectly good hair pin. In this note were words to the effect that "Dot" and "Alice" being lonesome and fond of big strong engineers would welcome the finders of their note. Their wigwam was the fourth from the hotel on Star island. (Star island can be reached from camp by paddling diligently for one hour.)

This finder of the note interested a second party in his findings, and after considerable hair-cutting, shaving, and general costuming, these two set out for Star island. They had kept their secret to themselves and their leave was quietly executed but not as quiet as their return a couple of hours later. Sad, sad news leaked out. "Dot" and "Alice" were a myth. Who wrote the note? You are referred to Clarence Velz. Who were the explorers? You are again referred, but this time to Louis Bevan and Herb Liese.

No camp is complete without its bus line. Our camp boasted of one of the best regulated bus lines in the state, if not in the world. Of course, the world takes in a lot of territory, but when you know that transportation to and from town was ever available, you will realize why we made such a

(Continued on page 30)


CIVIL ENGINEERS CAMP
UNIVERSITY OF MINNESOTA
CLASS OF 1924

HIGH TENSION IGNITION SYSTEMS

Their Characteristics and Operation---Claims for Series Gap Spark Plugs Too Optimistic

By Irwin M. Ellestad, B.S. '22, E.E. '23

ONE of the most important requirements of the internal combustion engine is a satisfactory means of ignition. Some of the early internal combustion engines used open flames and later hot tubes as a means of ignition. Another form of ignition which is used extensively at present is that employed by the Deisel engine, where air is compressed to a high pressure and after being compressed the temperature of the air is high enough to ignite the entering charge of oil or gas which is introduced into the cylinder at a pressure somewhat higher than the compression pressure. Of all ignition systems the most reliable, successful and satisfactory is some form of electric ignition and at present electric ignition is used exclusively on pleasure cars, trucks, tractors and aeroplanes. The literature and information available on electric ignition systems has largely consisted of descriptive matter for the use of operators of internal combustion engines. Up to the outbreak of the World War very little quantitative data on ignition devices were available but under the stress of national emergencies considerable research work was done both in America and in Europe, and the dissemination of the results of these researches has made available a large amount of information concerning the operation and performances of electric ignition devices.

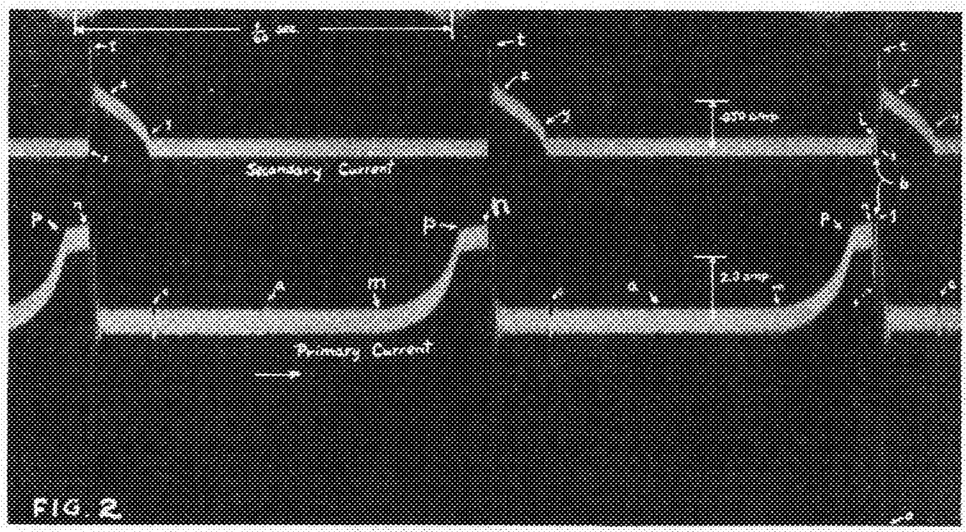


FIG. 2

There are two types of electric ignition systems, viz., the make and break or touch spark system and the jump-spark or high-tension system. The touch spark system is rather widely used, particularly on slow speed engines, but the high-tension system is in more general use and hence this article will be confined to a discussion of the method of operation and outstanding characteristics of the high-tension system.

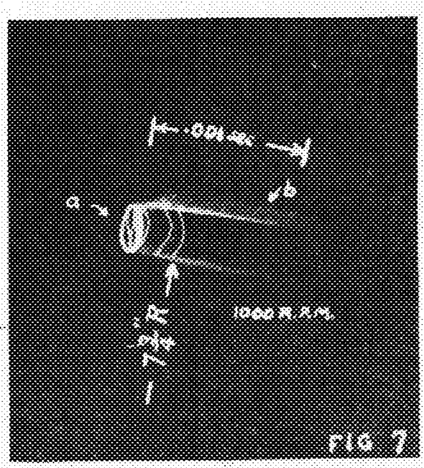


FIG 7

The circuit of any high-tension ignition system is essentially as shown in Fig. 1, where P is the primary winding which consists of comparatively few turns of coarse wire and hence has a low resistance, the secondary winding, S, consists of several thousand turns of small wire and consequently has a high resistance. The primary condenser, C_p, is connected across the breaker contacts to reduce sparking at the contact points. The usual value of this capacity is about .25 M. F. The capacity, C_s, on the secondary side may be called the equivalent capacity of the secondary. This equivalent capacity consists of a series-parallel combination of the capacity between turns, capacity between layers and the capacity between layers of the secondary winding and the frame of the machine. The condenser, C_2, represents the capacity between the spark plug leads and the frame of the machine. The effect of placing the spark plug leads in a metal tube is to increase the capacity, C_2. The two capacities, C_s and C_2, may be represented approximately by an equivalent capacity, C_1, shown dotted in Fig. 1. An average value of C_1 is about 100 micro-micro farads. Small as the value of C_1 is, it nevertheless is important and has a material effect upon the operation of any high-tension ignition system. The circuit of a high-tension battery ignition system is the same as that in Fig. 1 with the exception that a battery (shown dotted in Fig. 1) would be placed in series with the primary winding.

The sequence of events in a high-tension magneto which results in the production of a spark consists of a complex cycle of operations which the Bureau of Standards[12] has divided into six distinct periods and the nomenclature of the Bureau of Standards will be used in the discussion of the method of operation of the high-tension magneto.

Period 1

During Period one the breaker is closed and as the result of the rotation of the armature from the position of maximum flux to the firing position, current is generated in the primary winding. When ignition is desired the breaker is suddenly opened by a cam and the resulting rapid decrease of primary current induces a high voltage, $M\frac{di}{dt}$, in the secondary. At the same time the secondary, through the agency of a distributor, is connected to the spark plug in a cylinder where the compression stroke has just been completed. Referring to the oscillogram of Fig. 2, Period one commences at m and ends at n with the opening of the breaker. The rate of change of primary current is variable from m to p, Fig. 2, and as a result of this a variable potential whose value does not exceed a few hundred volts will be induced in the secondary. The magnitude of this induced voltage will be $L\frac{di}{dt} \times \frac{N_s}{N_p}$, where L is the primary inductance, N_s the number of secondary turns, and N_p the number of primary turns. The value of this induced voltage is much less than that required to fire the gap and along pn, Fig. 2, the rate of change of primary current is practically zero, hence this induced voltage will be minimum at break. In the oscillogram of Fig. 2 the duration of Period one is .004 second.

The shape of the building up curve of the primary current may be readily determined by opening the primary circuit and inserting a shunt of about .015 ohm resistance in series with the primary, across which resistance the oscillograph vibrator is connected, b and c, Fig. 1. The objection to this method is that resistance is introduced into the primary circuit which may be quite comparable with the value of the primary resistance. At low speeds the error due to this resistance may be considerable since the current is then limited by resis-

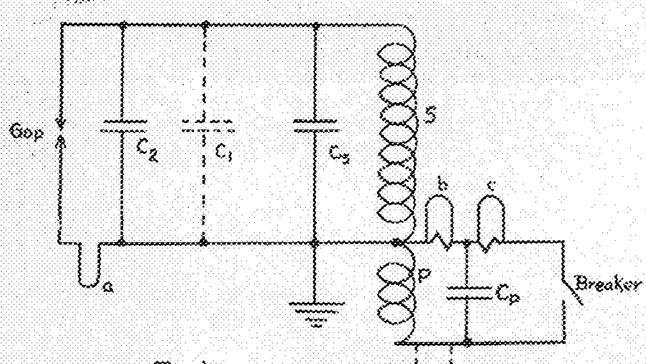
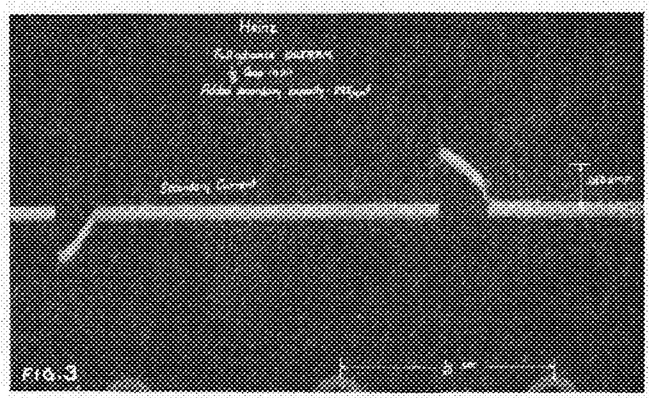


Fig. 1

tance, but at high speeds when the current is limited chiefly by inductance the error will be negligible. The construction of most magnetos is such that the oscillograph vibrators cannot be inserted at either b or c, Fig. 1, without the use of collector rings and brushes which would have to carry the primary current. The additional resistance introduced by collector rings and brushes may be sufficient to upset the circuit considerably, particularly at low speeds. If the oscillograph vibrator can be inserted at b, Fig. 1, the current through the breaker and the condenser surge will be recorded, while if the vibrator is inserted at c, Fig. 1, only the breaker current will be recorded. In magnetos which have stationary coils such as the inductor type or in battery ignition systems the vibrator may be readily inserted at either b or c. The writer was fortunate in having available an inductor type magneto (K-W Model 17) and the primary current curve in the oscillogram of Fig. 2 was taken with the vibrator in the circuit at b, Fig. 2.

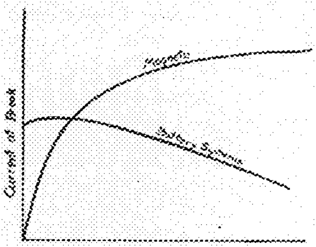
Period 2

This is a very short period whose duration is from the opening of the breaker to the instant at which the gap breaks down. The Bureau of Standards[12] gives the length of this period as about .00002 second. The oscillogram of Fig. 2 shows n, the opening of the breaker, and s, the breakdown of the gap, to occur simultaneously, but in view of the extremely short duration of this period the time scale of Fig. 2 is not sufficiently extended to show the short lag between n and s. This is an important period since what occurs during this period will determine if the secondary voltage will rise to a value great enough to fire the gap. When the breaker opens, the primary current flows into the primary condenser, no, Fig. 2, which rapidly charges it and the voltage across the primary condenser

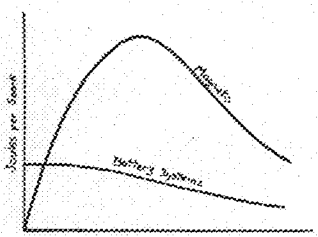


increases at a continually increasing rate with the result that the primary current decreases at a continually increasing rate. As a consequence of the decrease in primary current the magnetic flux decreases, and this decrease in flux generates a high voltage, $M\frac{di}{dt}$, in the secondary winding. This induced voltage sends a charging current into the capacity made up of the distributed capacity of the leads and the secondary winding. If energy losses are neglected, the maximum value which the secondary voltage would reach in Period two is given by the expression $E = I\sqrt{\frac{L}{C}}$, where I is the primary current at break, L is the primary inductance, and C is the capacity of the primary and secondary referred to the primary side. The eddy current and dielectric losses will reduce the value of the voltage actually obtained to a value much less than that theoretically obtainable. The preceding discussion as to what occurs during Period two is based upon the assumption that the breaker opens without sparking. If an arc forms at the contacts at break, a clean break such as shown at n, Fig. 2, will not be obtained; instead, the curve at n will be rounded off, the rate of change of primary current will be slow and consequently the induced secondary voltage will be less than what it would be if no arc occurred.

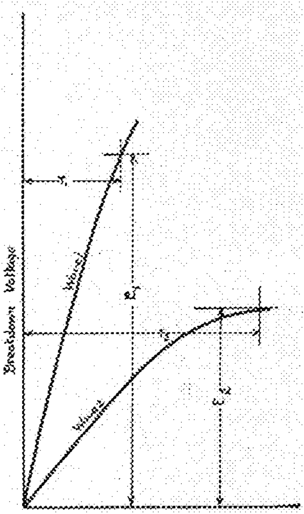
The expression for the induced secondary voltage shows the importance of the value of the primary current at break. The oscillogram of Fig. 2 was taken at neutral spark advance and a portion of the primary current curve, pn, is nearly horizontal. If the spark is retarded the length of the horizontal portion, pn, will be increased and the value of the primary current at break will be nearly the same at full retard as it is at neutral. However, if the spark is advanced, say to full advance, the breaker may not open along the horizontal portion, pn, but the opening of the breaker may occur somewhere below p and at a value of primary current at break lower than at either neutral or full retard. Hence since the maximum value of the secondary voltage is directly proportional to the current the maximum value of the secondary voltage may be less at full advance than it is at neutral or full retard. The writer has noticed some magnetos where missing occurred at full advance and oscillographic tests on one magneto showed that the value of the primary current at break when operating at full advance was less than when operating at neutral or full retard. To minimize missing at full advance the design of the magneto should be such that the horizontal portion of the primary current curve, pn, Fig. 2, is reached as soon as possible, i. e., the coil should be "fast." This means a lower value of primary inductance or a greater value of resistance and, referring to the expression for maximum secondary voltage, a decrease in the value of the maximum secondary voltage obtainable, other things being equal. Hence a compromise must be effected.



Sparks per Minute Fig. 4



Sparks per Minute Fig. 5



Time Fig. 6

Period 3

The duration of this period extends from the breakdown of the gap and lasts until a steady arc is established in the gap and this, too, is a very short period. At the instant of the breakdown of the gap a conducting path is formed through which the charged secondary capacity discharges. It is believed that this discharge is oscillatory and of high frequency. The oscillogram of Fig. 2 shows a series of oscillations between z and t but it is doubtful if the oscillogram shows the exact conditions. It is during this period that the capacity component of the spark is liberated and it is believed that this is the period which is fundamental to ignition.

Period 4

This period lasts from the establishment of the secondary current in a steady arc, z, Fig. 2, across the gap to the extinction of the spark, y, Fig. 2, and this period may last for an appreciable time. The duration of this period in the oscillogram of Fig. 2 is about .002 second. The most of the spark energy dissipated in the gap is liberated during this period. The decay of current in the secondary coil supplies the energy which is dissipated in the gap during this period and since the oscillogram shows the secondary current to decay nearly on a straight line, the voltage across the gap or the sustaining voltage will be constant. That is $E = -L\frac{di}{dt}$ = a constant. As the secondary current continues to decay the resistance of the spark increases rapidly from the commencement of Period four to a considerable value at the end. A considerable portion of the energy dissipated in the gap during this period, or the "arc," may be generated by the rotation of the armature through the magnetic field since the voltage generated by the rotation of the armature is comparable with the sustaining voltage of the gap.

The end of Period four or the extinction of the steady arc may occur in one of two ways. The first and most common way is the gradual decline of the secondary current to zero due to the exhaustion of the energy available in the secondary as the curve of secondary current in the oscillogram of Fig. 2 shows. The second method by which the arc may be extinguished is the closing of the breaker before the exhaustion of the energy in the coil as shown in Fig. 3.

Period 5

If the primary breaker closes before all the available energy in the secondary has been dissipated in the gap, an additional period is introduced in the cycle of operation. As the flux decreases due to a decrease in secondary current, this change in flux will induce a voltage in the primary winding which is now short circuited as the result of the closing of the breaker. This voltage builds up a current in the primary winding and as a result of the mutual induction upon the secondary, the secondary current is brought to zero. The events in this period are nearly the reverse of the events in Period three and the oscillogram of Fig. 3 shows this period to be of very short duration.

Period 6

This period extends from the end of Period five and lasts until the commencement of Period one of the next alternation. Throughout this period the primary current falls off approximately according to the equation, $i = I_0E^{-\frac{Rt}{L}}$, where I_0 is the primary current at the commencement of Period six (end of Period five), L is the primary inductance and R the primary resistance. If the extinction of the spark at the end of Period four is due to the gradual exhaustion of the energy supply, that is, the spark is not extinguished by the closing of the breaker, Period five will not occur and Period six follows immediately after Period four. If this is the case the current through the primary during Period six will be practically negligible as the oscillogram of Fig. 2 shows. The preceding discussion of the method of operation of the high tension magneto will apply in general to the operation of high tension battery ignition systems. The main differences between the operation of battery systems and magnetos are that the primary current is supplied by a battery and not by the rotation of a coil through a magnetic field and, second, that the addi-

(Continued on page 24)

ELECTRICAL ALUMNI MAKE GOOD

Graduates of this Department, One of the Youngest at Minnesota, Hold High Positions

By R. E. Mathes

IN preparing an article on the value of any department of a university and the achievements of its graduates, the natural thing is to make a comparison with the work accomplished by similar departments of other institutions. Before such comparisons can properly be made certain factors which vary at different institutions must be taken into account. Such factors are: the geographical location of the schools, the average social rating of the students, the age of the department, the proximity of the school to the commercial activities in the field of the department, and other factors of a similar nature.

The electrical engineering department at Minnesota was organized in 1887 by Prof. G. D. Shepardson, who is still the head of this department. The Engineering College was then known as the College of Engineering and the Mechanic Arts and was the youngest, and therefore the weakest, college of the university. For this reason the new electrical department had rather a difficult time in getting started. To this handicap must be added the fact that starting even at this early date it was some half century behind the electrical engineering departments of the large technical schools of the east.

It is surprising what a large part the geographical location with respect to the commercial activities plays in determining the fields of activity which the graduates of a technical school enter. For example, one well known technical school in the east, situated an hour's street car ride from the Lynn works of the General Electric Company, and about four hours' train ride from the Schenectady plant, sends approximately a third of her electrical engineering graduates into the manufacturing game with the large electrical manufacturing companies of the country. In contrast to this Minnesota, situated in the middle west where there is much contracting work and many independent power companies, sends a good third of her electrical engineering graduates into the central station game or the electrical contracting business. Many of the most important positions in the manufacturing companies are held by graduates of the eastern school; but just as many of the equally important at the head of power and contracting companies are held by electrical engineering graduates of Minnesota.

As a matter of interest the author compiled a very incomplete list of the electrical engineering graduates of Minnesota showing the positions of trust and responsibility which have been reached by our alumni:

The first class to be graduated in electrical engineering consisted of one man, Martin H. Gerry, Jr., who was given his sheepskin in 1890. He remained for a fifth year and received an advanced degree in 1891, after which he went out west to settle. Mr. Gerry is now the general manager of the Missouri River Power Company with headquarters in Helena, Mont.

The next class, 1892, comprised four students. Of these men Edward P. Burch was at one time assistant professor of electric railway engineering at Minnesota and is now a very well known consulting engineer in Minneapolis. William I. Gray is a large contracting engineer and has built up one of the largest electrical contracting concerns in the country, carrying on operations in all parts of the world. William Burtis is president of the Upper Iowa Power Company, and Monroe S. Howard is director and engineer of the same concern.

Of the class of 1893 Arthur W. Chase is a private banker in Moultrie, Georgia; William H. Dewey is a member of the Dewey Engineering Society; George H. Morse is a consulting engineer connected with the National Retail Molding Company of Subridge, Pa.; and Frank W. Springer is professor of electrical engineering at Minnesota.

Other electrical engineering graduates who have become well known as consulting engineers are Charles H. Chalmers '03, Edward J. Cheney '04, Earl D. Jackson '05, who is practicing in St. Paul, and Harold G. Payne '06, now of Boston, Mass.

In the central station work are Olaf G. F. Markhus '97, general manager of the Idaho Railway Light and Power Company; Styrk G. Reque '01, chief engineer of the Lehigh Navigation Electric Company; Alfred R. Frahn '08, manager of the Union Light, Heat and Power Company; Verney Gralin '99, with the Niagara Falls Power Company, and Arch R. Robinson '09, engineer for the Montana Power Company.

Manufacturing has taken a number of our good men, chief among whom are C. T. Hibbard '97, general manager of the Electric Machinery Company of Minneapolis, in which capacity he has done some wonderful work; W. L. Miller '97, of the Insulation Company of Winona; and C. Hoff '06, of the Lee and Hoff Manufacturing Company, manufacturers of electric elevators. Mr. Chalmers '03, besides his work as a consulting engineer is connected with a company manufacturing oil burners, while G. A. Kristy is connected with the Brilliant Searchlight Company of Chicago.

Many of our alumni have gone into teaching. These men have made a very enviable record for Minnesota in college engineering circles. Chief among these men are C. E. Magnusson '96, now professor of electrical engineering and dean of the College of Engineering of Washington University; Henry A. Erikson '96, professor of physics at Minnesota and very well known nationally as a leading physicist; G. H. Morse '93, the head of the electrical engineering department at the University of Nebraska; and J. A. Thaler '00, the head of the electrical engineering department of the Montana State University. Besides his work at the Washington University, Professor Magnusson has written text-books on electrical engineering subjects, his book on Alternating Currents being the one used by the seniors here at Minnesota.

Quite a percentage of the faculty of the College of Engineering at Minnesota has been recruited numbers nearly fifteen men and includes Professors Springer and Ryan and Instructors Todd and Swenson of the electrical engineering staff. In the other departments of the Engineering College are C. A. Herrick '02, and R. R. Herrmann '10, assistant professors of the mathematics and mechanics department, and B. J. Robertson '14, H. C. T. Eggers '15, E. W. Johnson '15, and H. E. Hartig '18, distributed throughout the college staff.

In the electrical contracting field are H. Lacklove '94, a large contractor in Seattle; A. L. Abbott '97, manager of the Electrical Construction Company of St. Paul; E. A. Artz '99, of Sioux City, Iowa; C. M. Ungerman '96, chief engineer of the Sterling Electric Company; G. P. Evendsen '08, proprietor of the Boustad Electric Company of Minneapolis; and Vernon S. Beck '09, president of the Beck Electric Construction Company.

A number of men have achieved quite some importance in the large electrical companies of the country. Western Electric claims C. C. Gilchrest '98, as secretary of the committee of manufacturing, a very big job with a not-so-big title; Jake Danner '01, head of the equipment branch of the engineering department; H. L. Burns '02, chief of the final inspection department; R. C. Mathes '12, research engineer, and many other lesser lights. Westinghouse has C. B. Gibson '05, in charge of the electric furnace department, Karl A. Simmons '05, in charge of the railway department; M. Cornelius '06, head of the switchboard department; Neil Currie '08, head of the small alternating current motors department. In the General Electric Company Victor E. Goodwin '04, is in charge of the lightning arrester department and Charles E. Fuller '01, is assistant patent attorney. Frank C. Helms '04, is a designer of synchronous motors and generators.

In the telephone business are J. E. Smithson '07, general manager of the Oregon-Washington Telephone Company; F. M. Rounds '95, division superintendent of plant for the Southwest Telephone and Telegraph Company; B. M. Bowman '04, telephone engineer of Newark, N. J.; Henry H. Glascock '06, proprietor of the New London Telephone Company; Oliver Sweningsen '08, district engineer of the Pacific Telephone and Telegraph Company, and P. F. Bunce '06, and R. E. Dahlstrom '10, respectively, district traffic chief and local traffic chief of the Northwestern Telephone Company.

In addition to the above mentioned men who have achieved success by sticking close to their professional work are many men who have won equal fame in other fields both allied with, and remote from, engineering work. Included in this group are H. A. Hildebrant '99, superintendent of buildings and grounds of the University of Minnesota; E. M. MacKusick '99, engineer of the U. S. Reclamation Service in irrigation and drainage; E. L. French '02, superintendent of the Union Carbide Plant at Sault Ste. Marie, Mich.; J. C. Vincent '03, electrical engineer of the City of Minneapolis; Irving R. Ely '05, expert electrical aide to the U. S. Navy; Marcus H. Stillman '09, physicist for the Bureau of Standards at Washington, D. C.; R. E. MacQuillan '11, a Colonel in the U. S. Army, and David Grimes '19, inventor of the inverse duplex system of amplification in radio receiving.

The records show that scientists of all grades in the Bureau of Standards, many Examiners and Assistant Examiners in the Patent Office, salesmen,

THE FRESHMAN-SOPHOMORE SCRAP

By James Sutherland

FOLLOWING the announcement of the All-University Council that classes in colleges having junior-college students were to be dismissed at 10:30 A. M. on Oct. 13, to permit the Freshmen and Sophomores to have their annual battle, interest centered on the College of Engineering, for the Engineers are known far and wide for their ability and willingness to scrap.

The Sophomore Engineers had held several meetings, and plans for their end of the scrap were well under way when this notice was made public. The Freshmen, however, were unorganized, although several ambitious spirits had been endeavoring to rouse class spirit. At the Orientation class on Thursday, Oct. 10, the first meeting of the class of '27 was held. At this time, James Sutherland suggested that they elect a temporary chairman to preside at this and subsequent meetings. He also gave his plans for the scrap. Edwin Skinner was elected chairman, and plans progressed rapidly. It was decided that all Frosh who were in the Chemistry building third hour were to leave there as a body. But, alas for the plans of the poor Frosh; they never reached their classes at all.

At about 7:30 Friday night, the plans of the Sophs started into effect. Sutherland and Skinner were captured and held all night. The Sophs hoped to prevent any organized resistance in this way. The following morning the poor, unsuspecting Freshmen were captured ignominiously, singly or in groups, by the Sophs, who had been on the Engineering campus since 6:00 A. M. By 8:30, fully seventy-five were assembled in the rear of the Main Engineering building, tied hand and foot, with their faces calcimined a brilliant green.

Then the worm turned. In some unaccountable manner, some fifteen-odd Freshmen had collected inside the Main Engineering building. Promptly at 8:30 they filed quietly out of the rear door, and proceeded to slash the ropes of their classmates as fast as possible. As the Frosh were cut loose, they turned to, and held at bay the few Sophs who were supposed to be guarding them, while the others proceeded with the cutting. In a few minutes a battle royal was raging. Parties of Sophs out scouting, on getting wind of the reverses the side was suffering, rushed back and proceeded to throw their strength in to try to gain victory. The battle continued for over half an hour, but neither side got anywhere. As fast as members of one side were tied up and out of the way, some one would come along and cut the ropes, so neither side got anywhere. About 9:15 "Stew" Willson and several other upper classmen got together and decided to call the fight a draw. When this announcement was made both sides were so tired out and winded that they could not object. They all just laid down and gasped.

Later someone suggested a snake dance, and the idea was heralded with delight. Everyone, from the green Frosh to the dignified Seniors, fell into line, and off they started for the main campus, singing, cheering, laughing, everybody having a good time, class of '27 marched arm in arm with class of '26; there were no classes now, they were all just Engineers. In the middle of the parade grounds the procession stopped, while they all gave the Engineers' favorite yell. Then off the dance started

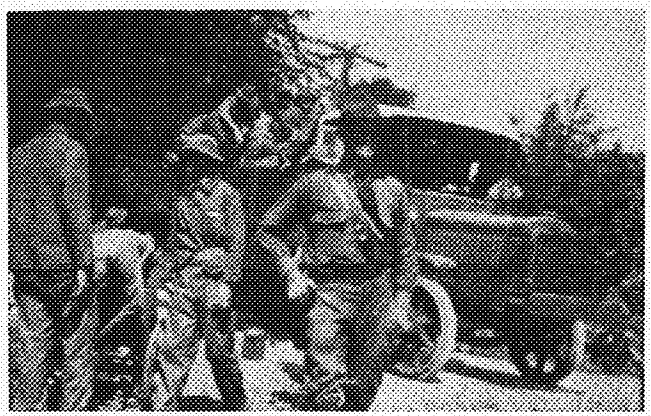
THE SIGNAL CORPS AT CAMP CUSTER

Rookies Get Six Weeks of Military Training, Interspersed With Inspection Trips and Entertaining

By Marvin C. Rogers, C '26

MINNESOTA was represented at the Camp Custer R. O. T. C. camp this year by 14 engineers who are members of the Signal Corps unit in the Military Department here. Except for the hot weather, which lasted throughout camp, everything was agreeable.

The group left Minneapolis June 20 on the "Pioneer Limited." The trip to Chicago was uneventful except for the fact that the weather prevented comfortable sleeping. Chicago proved to be too interesting for Robert Beveridge, who turned up missing, or, rather, wasn't to be found when the train to camp was due. He reported at camp shortly after the rest of us and tried to explain that he was held by the gateman at the depot. The trip to Battle Creek went quickly and was made interesting by meeting Lt.-Col. Miller, who inspected the R. O. T. C. here last year.

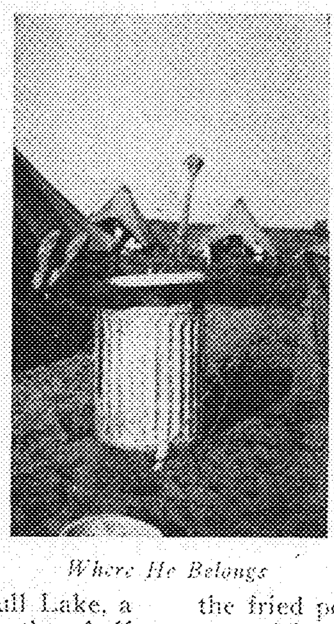


On Maneuvers

When we arrived at Battle Creek we found Sgt. Strider and an army jitney waiting for us. After riding five miles with nothing to sit on except the south side of a pine board we arrived at camp headquarters, registered and were assigned to our tents in Co. D. We were greeted with a heavy rain that gave us our first experience in getting the stubborn tent sides fastened before the rain stopped. When mess call blew at 5:30 p. m. it surely was welcomed by us. It was our first camp meal and we made it a record one.

The next morning Captain Watson took us to the Quartermaster, where we were fitted with new "tailor made" uniforms and "dress shoes." We "fell in" for the first time in uniform that afternoon and were initiated by a hike to the demonstration field which was 67 mess shacks away, or about one mile. The demonstrations included all methods of warfare and were interesting.

Saturday morning we were "shot" for typhoid and smallpox and as much as we resisted we could not keep from feeling drowsy. We were excused from the parade that morning and were thankful for that because "Old Sol" was working true to form.



Where He Belongs

The first convoy of trucks to go to Gull Lake, a summer resort, went Sunday and no less than half the men in camp went there to spend the day. Every one remained until the trucks left for camp at 10 o'clock. Regular nights for the cadets were established at the lake and Tuesday evening was "Col-

hostess house every Friday evening, and trips to the world famous cornflakes plants and the sanatorium in Battle Creek. Every one of us has seen "corn on the cob" go into one side of a machine and cornflakes come out the other side.

The indoor sports which provided most of the pleasure we had were: catching mosquitoes inside of our mosquito netting, running the guard after taps without a pass, keeping more than half of the rain out of the tent during a storm and getting dressed in less than two minutes. All of us became experts in these sports.

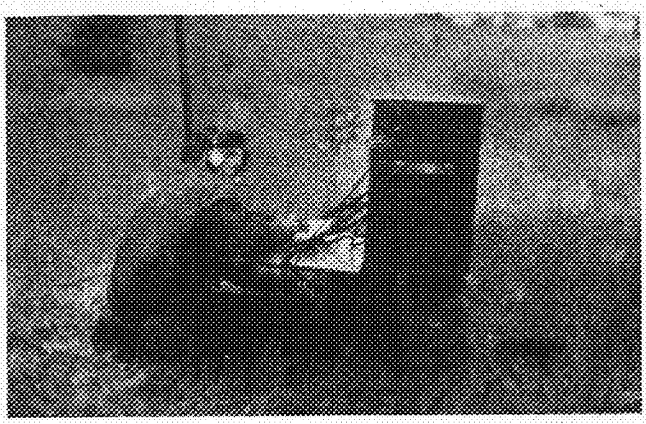
The camp training consisted of Infantry drill, physical training, better known as P. T., wire and radio communication, pistol marksmanship, military courtesy, map sketching, guard duty and military tactics in general.

In wire and radio communications we assumed certain conditions and went about the work as though a battle were actually being carried on. We did not do very well in pistol marksmanship and only one-fourth of our men qualified in the record shooting. It is said that a soldier is not a soldier until he has been on K. P. and in the guard house. Sgt. Strider took care of both details and saw to it that all of us got our turn. We agree that we don't mind washing a hundred dishes at a time but when it comes to washing twice that number three times a day it is tiresome. Joseph Juran will confirm the writer's sentiments. Military courtesy went all right until the Reserve Officers arrived, then all of us were given the opportunity of saluting regularly.

There were about 440 cadets in the R. O. T. C. camp, making three companies of Infantry, one of Signal Corps, a platoon of Engineers and a company of Cavalry. These men represented colleges and universities all over the Middle West. One of the advantages of the camp was the opportunity to meet men from other schools. School spirit existed throughout camp and all were like brothers.

We were given plenty of food, or chow, as it is called in the army, and it was all good, with the exception of the fried potatoes and the pie crust. The potatoes were fried the way mother makes doughnuts and the pie crust resembled beef. With those exceptions everything was all right and all of us returned in better condition than when we left home.

Captain Watson sponsored two trips out of camp where we visited the Ford Motor Company and a few other places. The contrast between the Ford and Roamer plants is interesting. The output of the Roamer Company is 10 cars per day; of Ford, several thousand cars per day. The Roamer car is assembled by hand one piece at a time while the Ford is assembled by both man and machinery several parts at a time. Where one nut is fastened in the Roamer car perhaps six are fastened by one machine on the Ford. The most noticeable thing about the Ford plant was that each man was assigned to a certain task and was held responsible for its performance.



Operating in the Field

We stayed at Fort Wayne while in Detroit. The old fort, which faces the Detroit River and the Canadian shore, has been well preserved, for the walls with its gun turrets and rifle ports are still remaining. Uncle Sam furnished us with military springless sight-seeing cars and we traveled over a great deal of Detroit. The city is interesting since it has in it nearly every color and race which the world knows.

At the close of camp, Donald Thorne, E '23, was commissioned Second Lieutenant in the Officers Reserve Corps of the army and Leonard Arstad, E '24, received one of the honor medals given for military excellence. The rest of us received camp training certificates. Camp was demobilized on the 25th of July and all of us excepting Richard Mathes, who went on the Great Lakes as radio operator, and Donald Thorne, who visited friends in Michigan, left for Minnesota at noon that day.

We made a stop-over in Gary, Indiana, and visited the Illinois Steel mills and the Universal Portland Cement plant. At the steel mills, we watched the manufacture of steel from the time the ore was unloaded from the ship until it came out of the rolling mills in the form of railroad rails. We saw the blast-furnaces, open-hearth and Bessemer steel processes and the rolling mills. Our eyes opened wide when we saw ladles of iron and steel containing between 75 and 100 tons of molten metal. At the cement plant we watched the slag and limestone being ground and fused in long rotary kilns to be ground over again and again until samples of it show that 78 per cent of it will pass through a 200 mesh screen.

That same evening found us in Chicago, where we stayed until Monday morning. Captain Watson, Gus Haedecke and Gordon Volkenant joined us there. We gave the city as thorough an inspection as possible in that time, visiting the Western Electric Company, the University of Chicago, Northwestern University and Sears Roebuck and Company. The Western Electric Company was host to us for a day while we saw the manufacture of cable, switchboards and nearly every piece of telephone equipment in use at the present time. Sears Roebuck and Company gave us a good example of how a firm doing business amounting to millions of dollars yearly handles its goods in the shortest possible time. We met Professor Swan, formerly of Minnesota, at the University of Chicago.

Monday morning we went to Waukegan, Illinois, where haircuts are 75 cents, and visited the American Steel and Wire Company. We saw nearly all kinds of wire being drawn out, and the making of wire fencing and nails. We reached Milwaukee at noon and, although footsore and tired, visited the Cutler-Hammer Company and Allis-Chalmers Manufacturing Company. At Allis-Chalmers, we saw the large engines and generators which we had seen in use in the steel mills and power plants, being manufactured. Someone suggested that we go to a tanning factory, but we were too anxious to get home. Every train that left that evening carried some of our number.

We are indebted to Captain Watson and Professor Shepardson for the success of the camp and the trip. Captain Watson accompanied us on the trip and Professor Shepardson arranged for the inspection trip.

The Company Street

The cadets who attended the camp were: Donald E. Thorne, Richard E. Mathes, Leonard C. Arstad, Edward W. Nelson, Curtis W. Eckberg, Joseph M. Juran, Gus D. Haedecke, Ray W. Keller, Roy O. Franzen, Marvin C. Rogers, Robert A. Beveridge, A. Palmer Baker, Gordon W. Volkenant and Percival R. Knapp.

A. C. Petrick, '19, and wife and baby were visiting with relatives and friends in Minneapolis during August. Mr. Petrick is now employed as salesman for the Burke Electric Company of Cincinnati, Ohio.

H. J. Beeman, '21, is to be found at 1134 K St., Lincoln, Nebraska. Mr. Beeman is assistant superintendent of construction for the A. Moorman & Co., who are erecting a large bank building in Lincoln.

Each year a number of graduates find their way into railroad work. Of the '23 class the Great Northern Railway Company's valuation division has taken seven men. They are: Gerald Case, Graydon Bachman, Wayne Feeney, Paul Swanson, Walter Maiser, Raymond Spencer and Walter Katz,

ALUMNI NEWS

LUEDEMAN EXPECTS TO WRITE ARTICLE FOR TECHNO-LOG

We have lately had news from Clarence Luedeman, who last year completed the course in Architectural Engineering with the honor of being the first graduate of this course with a degree of Bachelor of Science. He is now working for the firm of Holabird & Roche, Chicago. The following is an excerpt from his last letter:

"Things have been going at a great clip in the office. You probably know that four more stories were added to the Trib. Tower. Total height above Michigan Avenue = 455′ 0″. This change in plans necessitated a new 'permit set' and, believe me, things were hot for a while. The upper floors had to be redesigned and it fell to me to design all floors and structural steel from the 27th floor up to the roof of the tower. I thought this was pretty nice, for I sure learned a helluva lot while thus engaged. The 'permit set' was due October 1st. Since then I have been working with Gray, designing and laying out wind bracing.

"Our location on the fifth floor has many decided advantages. The Y. W. C. A. is located just across the alley from us. Most every day we are entertained royally by the 'maidens fair,' for 5:00 P. M. is the official bathing hour. The baths are directly opposite the drafting room of Holabird & Roche, you understand, and needless to say, all work ceases when the spectacle is put on. I, personally, have been putting in much overtime of late (no pay, but what's the difference). Brewer and I are computing curves in order to establish a more accurate check upon this rare phenomena. I hope to be able to contribute an article to the Techno-Log as soon as I have compiled enough data."

We have this report from the news bureau of the General Electric Company at Schenectady, N. Y. E. S. Bjonerud, '22, has completed the students' training course of this company. He has been transferred to the San Francisco office of the company, where he is engaged in sales work.

Nels Johnson, '23, has been with the Corrugated Bar Company of St. Paul since graduation. His address is 1110 5th St. S. E., Minneapolis.

Frank Christlieb, '23, is employed by the Fairbanks-Morse Company. He is working out of the St. Paul office.

Walter Maiser, Paul Swanson and W. E. Katz, all of the 1923 class, are in the evaluation department of the Great Northern R. R.

A. C. Zimmerman, '23, expects to leave shortly for Washington, D. C.; he is to enter the U. S. Coast and Geodetic Survey.

E. H. Pagenhart, '05, is director of coast surveys in the Philippine Islands. This work is under the direction of the U. S. Coast and Geodetic Survey. Much of this work is done from boats, of which Mr. Pagenhart has three under his direction.

The St. Croix River Project of the Byllesby Engineering and Management Corporation is furnishing work for a number of our alumni. Jim Darrel, '23, started last spring as an instrument man and is now in charge of one of the camps. It is rumored that he intends to take on a life contract in the near future. Bill Kelly, '22, who will be remembered as a pole vaulter of no mean ability, is one of the instrument men. Mrs. Kelly is with him. Herbert Berdan, another of the instrument men who has been on topography, is now on construction work in Chippewa Falls, Wisconsin, with the same company. Leo Buhr, '23, and Seymour Cray, M. S. '23, are instrument men on the same location. Henry Manger, '23, and George Guesmer, '23, are employed as draftsmen. These men, with the addition of James Alexander, of the School of Mines, completes our list of Minnesota men who are working on this new project. From all reports we understand that the boys are doing very good work.

We have been informed that W. E. Beneke, '20, Gus Swenson, '20, and O. C. Hanson are at present located in Los Angeles, California.

C. F. Moore, General Engineering 1920, was visiting at the University of Minnesota the other day. He is on bridge inspection for the Minnesota State Highway Department. His work has carried him to Breckenridge, Brainerd, International Falls and Tower.

Several men from the University of Minnesota have found employment at the Northern States Power Company. We have news of E. J. Magney, '21, "Dusty" Kearney, '23, and C. C. Schweisso, '23. Magney and Kearney are in the sales department. Schweisso was married during the summer.

R. B. Bauer, '23, has entered the services of the Western Electric Company at Chicago. He is located in the engineering department.

Ed. C. Hanrahan, General Engineering 1921, is now engineer on construction for Pierce, Greeley and Hanson, consulting engineers, on sewer and water system installation. Mr. Hanrahan is working on a job at Michigan City, Indiana. In October he made a visit to Minneapolis during which he called on Professor Zelner at the Engineering College, University of Minnesota.

Le Roy Grettum, '23, whose editorials and activities will be missed this year, is now with the Wisconsin Railway Light and Power Company, Winona, Minnesota. He is engaged in electrical engineering.

Aubrey Leonard, '23, is assistant highway engineer for Olmsted county. He can be reached at the Y. M. C. A. at Rochester, Minnesota.

Richard Pulver, Electrical '23, is assistant to the chief electrical engineer for the Northwestern Paper Company at Cloquet, Minnesota. The company is building a large addition to their plant in which Mr. Pulver is working.

Hans Bernt, '19, is working for the Ford Company. He is at present located in Northern Wisconsin.

Thompson, '22, is resident for the Minnesota State Highway Department. He is now at Two Harbors. His residency is located in a territory composed of a large quantity of rock.

Carl Aslakson, '23, has taken a position with the U. S. Coast and Geodetic Survey. There is no news of his location.

Oliver Stoutland, '22, is located with the Minneapolis Steel & Machinery Company where he is employed as an estimator. Stoutland has lately become the proud father of a baby boy.

Byron K. Curry, '23, has written us from Dixon, Illinois. He is employed by the Sandusky Cement Company as civil engineer. Since entering the services of this company, he has accomplished a topography survey of the company's property and made estimates of their quarries, designed drainage systems and culverts for the quarries and plant. The "Admiral" has been doing well, no doubt. He has made the required payment on a Buick roadster.

Art A. Sauer, '23, is employed by the Toltz, King & Day, engineers and architects of St. Paul.

Ed. Friedman and John V. Lundquist, both of the '23 class, are employed in the mining company's electrical repair shop at Hibbing, Minnesota. Mr. Friedman is on construction and Mr. Lundquist is doing armature winding.

Carl Odquist, '23, has taken a position as county road engineer. He has been working on the Birch Lake Road in Ramsey County.

H. M. Hill, '23, has been with the Coast and Geodetic Survey since June 26, 1923. He has been on precise triangulation work in Northern Montana, north from Borgeman to the Canadian border and then west to Glacier Park. His present address is U. S. C. and G. S., Washington, D. C.

P. E. Francis, '18, is fuel engineer in the St. Paul office of the North Western Fuel Company. He is living at 909 West Franklin Avenue, Minneapolis.

Harvey King, '18, will be professor in charge of the department of architecture at the North Dakota Agricultural College at Fargo. The department is young, and he and Edward Holien, '23, will be the whole faculty.

Not only did Dan Cupid lay "Klenie" Kleinschmidt low this summer but he also caused the fall of Harry David, '19, and Edward M. Loye, '20. Ed was married on June 12th to Laura Peck, while a week later Harry become the husband of Mary Maher. Mr. Loye is now with Warren & Wetmore, New York, and resides in Brooklyn. The advertising game has attracted Mr. David and he has offices of his own in the Merchants Bank Bldg., St. Paul.

Carlyle Rick, C '20, and Helen Corilla Miller were married recently and are now living at 6246 Park avenue, South Chicago.

Victor Yngve, '13, C '14, was in the Twin Cities for a visit in September. He is director of the research for the Manhattan Electrical Supply Co., 45 Morris St., Jersey City, N. J.

Oscar C. Schermer, C '21, is working for the Manufacturers Chemical Company in St. Paul Park.

Leslie R. Olsen, C '15, and his family, which includes Mrs. Olsen and their little son, Donald, are now residents of Minneapolis, at 4702 Lyndale avenue south. The International Milling Company, with whom Mr. Olsen holds the position of chief chemist, moved their general offices and laboratory from New Prague, Minn., to the Flour Exchange building in Minneapolis last June.

Harvey M. King, '18, is to head the Department of Architecture at the North Dakota Agricultural College, Fargo, this coming year, succeeding Stanley A. Smith, resigned. Edward O. Holien will be Mr. King's right-hand man. Mr. King goes to North Dakota after spending the last year at Boston Tech. and receiving his M. A. Mr. Holien obtained his B. S. in Architecture at Minnesota last June, winning the Moorman prize as a fitting climax to his undergraduate work.

Mr. King's letter, dated Sept. 14, reads in part as follows: "As you know my endeavors last year were centered chiefly around 'Tech,' which is an interesting place to spend a year, especially for one who wants to put in a little time in the East. Every man has his own preference, but I am pretty thoroughly converted to the one that granted me a Master's in June.

"Tomorrow evening I leave St. Paul for a new location at Fargo, where I succeed Stanley A. Smith, head of the Department of Architecture, who has accepted an offer at Washington State College. This year Minnesota will be well represented at the North Dakota Agricultural College with two of her men on duty. Eddie Holien is to be there, too. If any of our friends pass through Fargo this coming year we'll be glad to see them."

RUST PREVENTION IN REINFORCED CONCRETE

The development of rust in reinforced concrete and the best methods of prevention have been examined by Dr. Goslich of Berlin with the assistance of a committee. Three typical Portland cements were used, the cement mortars consisting of cement and sand in the ration 1:2, 1:3, and 1:5, respectively, and the reinforcing rods 0.4 inch diameter were covered to various extents. The results, according to Zement, of Berlin, show that to ensure the reinforcement being properly protected it must be covered with at least 0.8 inch of 1:2 cement-mortar. The sizes of the sand grains and of the interstices between them are less important than the richness of the mixture. A 1:2 mixture is superior to 1:3 as regards prevention of rusting, and 1:5 is satisfactory if the reinforcement is sufficiently deeply embedded.

If the conditions are sufficiently severe, rusting appears to be inevitable unless the reinforcement has been covered with a waterproofing agent.

EDITORIALS

THE UNORGANIZED SCRAP

There has been much discussion as to the merits of the organized and unorganized Freshman-Sophomore Scrap. Both serve, for several weeks, as a topic of conversation to the participants. The real aim of both, however, is to instill a university spirit in the incoming student, and to let him know that there are many things happening outside of the classroom. With this as a motive it is evident that the unorganized scrap, in its present form, is the better of the two.

The Engineers' Scrap has been more or less of an individual contest, the Sophs either gently or forcibly requiring the Frosh to adorn their features with green paint. Though this is a rough and ready battle and a few bruises and scratches result, there have been no such "hog-piles" as we witnessed on the Academic Campus. Neither have we found it necessary to take any of our participants to the Health Service as was necessary before the S. L. and A. Bag Rush was finally completed. The personal factor in the unorganized fight we believe to be far more desirable than the mob tactics which feature the organized.

These scraps may not be desirable but they will exist until a better substitute replaces them. The same is the case with the engineers' annual Gayety Party, which is beginning to lose its popularity. This affair is gradually being replaced by a similar party at the Orpheum, where a much better class of both show and audience is to be found. Here, a substitute, far better than the original, has been found and though it is new we are confident that it will replace the old.

The Engineering College has a reputation for turning out "red-blooded" engineers, men who do things worth while. Our scrap is in keeping with our reputation, but the Gayety party is not. A tradition, to be worthy of maintaining, should never be one for which we must make excuses.

Next year we want the unorganized scrap but when it's over let's make it "Get your tickets early, fellows. We have reserved the downstairs of the Orpheum and we are all going."

By the way, Harold R. Peterson now announces the birth of Leonore on April 10th. Harold was disappointed because his second was not a boy, but the second little lady has won his heart and all is well.

Cigars were passed twice in the office of C. H. Johnston, state architect, St. Paul, this fall when John R. Corwin and Stewart V. Wright, both from the University of Minnesota, announced arrivals of the stork. Marilyn and Stewart V., Jr., are extended greetings and their mothers and fathers congratulations and best wishes.

In Memorian

PROF. JOHN HOWARD ROWEN of the Department of Mechanical Engineering of the University of Minnesota died on Friday, September 7.

Professor Rowen is survived by his wife and three children, Mrs. Norman S. Flook of Ann Arbor, Michigan; William Howard, and John Albert of Minneapolis.

Professor Rowen was born in Philadelphia and attended public school until his third year in high school, when he was appointed to the Naval Academy at Annapolis, from which he graduated in 1891. After serving two years on board ship he was commissioned as Assistant Engineer and passed through the various grades until his retirement as commander in 1911. While in the service in the Navy he was present at the quelling of the Boxer Uprising in China and spent eight years at various times in the Philippines. He taught at the University of Michigan for two years and was called back into active service when the United States entered the World War. He served as Naval Inspector of Machinery at the Allis-Chalmers Company, Milwaukee, Wisconsin.

He came to the University of Minnesota in 1921. He was Associate Professor of Steam Power Engineering at the time of his death.

Professor Rowen was a member of the American Society of Mechanical Engineers, American Association for the Advancement of Science, National Geographic Society, Engineers Club of Minneapolis, Society for the Promotion of Engineering Education, Society of Naval Architects and Marine Engineers, Pennsylvania Society Sons of the Revolution, also honorary member of Pi Tau Sigma. He also held membership in various naval clubs.

He was an excellent teacher and very popular with the students.

COLLEGE NEWS

ARCHITECTS

Several changes in the faculty of the Architectural Department have been made this autumn. Mr. R. C. Jones and Mr. R. T. Jones have been advanced to associate professorships; and Mr. Rhodes Robertson, a Harvard graduate now connected with the firm of Hewitt and Brown, has been obtained to act as professor of Grade I design.

The wild west wind, that breath of autumn's being, bears on its wings this particular year, hints and whisperings of a fishing trip taken during the summer by three members of our faculty. Or was it four? The hints are somewhat vague; but we are almost inclined to say that the number was four, as follows: Mr. Arnal, Mr. R. T. Jones, Mr. R. C. Jones and another wind-bag. The hints unfortunately do not tell us who the fourth member was, but certain it is that he was blown up each night (one can fancy why, and how) by Mr. Jones—R. C.—and thereafter slept upon. And that sleeping with a wind-bag is an impossibility was again proved by the fact that Mr. Jones rolled all night long, from side to side, according to whether the wind was in the east or had shifted over to the west. Certain it was that there was no rest to be got under, or, rather, over these circumstances.

As for the trout, we cannot say outright that their size has been much inflated since the date of this northern sojourn, but we know that they flourish in fast colors in the imaginations of the three anglers, and we trust that before the season is out they may have had the virility to grow in a manner as interesting and praiseworthy as did the famous turtle of the Ecole des Beaux Arts fountain.

WILD NELL, THE PET OF THE PLAINS,
Or
THE FAVORITE OF THE FRONTIER

was the piece de resistance of the evening's entertainment on October 11, when the Freshmen of the department were entertained by the Architectural Society. This was a mimed play full of thrills, heart-throbs, and a most piteous self-abnegation on the part of the lovely heroine. Two immense war-canoes did race madly, in which the Lady Vere de Vere, captured by the Cruel Red Man, was pursued post-haste by Wild Nell and Handsome Harry; an Indian camp-fire did flicker—flicker flame in true camp-fire and equally ghostly fashion, within whose mystic radiance did prophesy the wrinkled old medicine-woman; our dashing heroine made her great sacrifice—these events, together with a generous atmosphere of wild-west bravado, alkaline in flavor, made for a drama as gripping as one could wish to grip.

Verna Smith threw herself heart, soul, body, arms and legs into her part as Wild Nell; and threw herself out of the war-canoe into the river besides. The part of the Lady Vere de Vere, swept out of a tour de luxe by the fierce but discriminating arm of the vindictive Red Man, was played by Bernice Kimmerle. Handsome Harry, a piece of unusually high acting, was played by Dorothy Mann. Local color in the way of Indians, medicine-women and other items of indefinite hue, small value, but a very real intensity was supplied by Florence Knox, Mary Slocumb and Helen Parker. Cy Pesek, with an eye for every little theatre movement, acted as showman, producing the cacti and other alkaline accessories soon after the needful time, and explained the pantomime as it unrolled its panoramic marvels before the spell-bound audience.

Wallace Bonsall, president of the society, made several speeches during the course of the evening, and Mr. Mann and Mr. R. C. Jones made one apiece. Ice cream, striped after the so-called Neopolitan fashion, cup-cakes, but no coffee, continued the edifying train of events, winding up the evening with a clatter of spoons and the delicate noise of falling crumbs.

MECHANICALS

The Experimental Engineering Department is now installing considerable new equipment for gas and steam engine work.

A 30 H. P. Worthington Diesel engine 10¼x10½ of the vertical type is being assembled. This will be the largest gas engine in the laboratory.

The only reciprocating steam engine purchased is a Troy of the slide valve type.

A new Terry turbine running at 1,150 R. P. M. and rated at 15 H. P. drives a centrifugal fan to be used for work on air flow and new type of air flow meter. This turbine is equipped with a Worthington condenser which may be alternated with an hydraulic air ejector similar to those used at the Riverside station.

This year brought many changes in the faculty of the Mechanical Department. The deaths of Professor J. H. Rowen and Mr. E. P. Quigley caused a great loss to the department. Professor J. J. Flather is in California on a year's leave of absence. Mr. V. Gauvreau is in Detroit, Mich., taking charge of an estate. He was formerly instructor in Machine Design. Mr. J. W. Nilson, instructor in Machine Shop Practice, is in business for himself in Deroit, Mich. Mr. P. W. Rhame, former instructor in Automotives, is now with the A. C. Spark Plug Co., Flint, Mich.

Mr. Ronald M. Hazen is the new instructor in Automotives, Gas Engine and Laboratory. Mr. John Flodin will teach Mechanism, Machine Design and Advanced Design. Mr. C. C. Sampson is instructor in Steam Engine Design and Elementary Laboratory.

Mr. C. Robert Egry and Mr. Lawrence Campbell teach the courses in Heat Engines and Elementary

Laboratory. Mr. Dayton A. Rogers has charge of the Machine Shop, and Mr. Thomas P. Hughes of the Forge Shop.

ELECTRICALS

The Electrical Department has, as usual, survived the summer vacation period and is again running full blast. Another set of sophomores have inherited the dark and gloomy dungeon officially known as the sophomore laboratory, together with the magnets and sugar shakers filled with iron filings with which to illustrate the action of the "Magnetic Lines of Force." A goodly majority of last year's sophomores have been elevated to D. C., a la Langsdorff and Prof. Springer, and to the steam heat generated by a prony brake on a series motor. Even at this early stage in the game the seniors are burning the midnight juice in a fruitless attempt to dope out the correct answers to problems in the manipulation of vectors and complex quantities and the solution of A. C. networks. Verily, were an alumnus to return to the old building, the home of the EE multitudes for some many long years, he would hear the same questions asked that he himself asked at some time in the dim and distant past. "What did you get for the phase angle?" "If I design my machine for forty-eight slots will that work for both wave and lap windings?" "How are you supposed to develop the expression for the field at the center of a solenoid?" "What answer did you get for those two resistances in parallel?" Yes, they are the same old questions but are asked by a new set of victims.

Not only did we survive the summer but we have returned to work in greatly increased number. Last year at the opening of school the instructors were often heard to remark that the classes were so large that they didn't know how they would be able to handle everyone. Such has been the complaint at this time of year for five years or so and the year of 1923-24 is no exception. The junior and senior classes are each about twenty per cent larger than last year but the sophomore registration has fallen off somewhat. This year there are 69 seniors enrolled as against 59 at this time last year. The junior class has increased from 61 in the fall of 1922 to 80 this fall. To offset this somewhat the sophomore class has decreased from 110 in 1922 to about 90 in 1923.

This great increase in the size of the upper classes has made the laboratory conditions such that it is very difficult to regulate the work of the classes. It was thought last year that the peak had been reached in the growth of the upper classes and calculations for this year were made on that basis. The unexpected increase has in large part been due to the return to school of men who have been out a quarter or more so that it was impossible to count on them for this year.

The registration in the Radio Communication course offered by Prof. Jansky is this year the largest ever. This increase has been caused by the combined influence of a large senior class and the great popular interest in radio broadcasting. The elementary telegraph course also has an over-registration and men were turned down from the advanced course in the Signal Corps R. O. T. C. Judging from the interest taken by the senior class in central station work, Professor Ryan will have his hands full all year.

The problem of properly handling such large classes is no easy one but with the co-operation of all concerned, both faculty and students, the best solution will be worked out for this year and we will have no further cause to worry as we will be in the new building next year and will have space and to spare.

A large number of the members of the senior class put in a very profitable summer doing work closely associated with their chosen field. The St. Paul Gas Light Company last spring made bids for the services of six of the men. Upon reporting for duty these men were assigned to duties as ground men on line construction sections and were put to work with picks and shovels digging holes for the poles. Having performed these arduous duties well and faithfully for some six weeks our brilliant young engineers were occasionally allowed to try to elevate themselves by the use of the climbers. The net result was that there were a goodly number of slivers and scratched arms acquired in the process.

The notables who participated in these exercises were Joe Mayer, Lyle Morton, Henry Strege, Don Swift, Ben Trecka, and Lawrence Warren.

The Western Electric Company was honored during the past vacation by A. A. Waligoski and George Husby, seniors, and by G. F. Gilman, a junior. Wally and Husby were writing specifications in the engineering department of the main plant at Chicago and Gilman was in the drafting department.

Hilding Mangney had the enlightening task of keeping a solder pot hot for the Power Service Company of Evanston, Ill. His entire complement of tools consisted of a vast and varied assortment of matches, safety and otherwise.

PROGRESS MADE ON THE NEW BUILDING

At the close of the last school year the hole in the ground for the new electrical engineering building had just been completed. Since that time much progress has been made. The brick work for the walls has been completed for the first and second floors and the concrete flooring for those two stories has been poured and has set. The concrete is now being poured for the floor on the third story over the main laboratory section. The flooring for the balcony in the main laboratory has also been poured and it is now possible to get a fairly definite idea of the layout of the lab.

That lab is so big that a person may easily become lost in it after having been used to the cramped and cluttered condition of the laboratory in the present building. The wire channels have been laid out in the concrete floor about twenty feet apart and will make it extremely convenient to run temporary wiring to any part of the laboratory for experimental setups. It is planned to carry this idea of wiring channels and wells throughout so that it will be possible to run wires from one part of the building to any other part with not more than about fifty feet of exposed wiring. This development is not apparent with the building in the present state but should appear soon.

The shaft for the heavy freight elevator that is to be provided to carry supplies to all floors has been built into the walls and gives an observer the feeling that the building is to be used as a commercial establishment rather than a college laboratory. It certainly adds an air of big accomplishments to the whole building.

CHEMISTS

Mixer No. One

On the evening of October 8th, chemists—old and new—met in Four-Ninety for a mixer. The occasion was a welcome to the new freshmen, and was sponsored by the newly-formed Student Chemical Society.

The principal speakers for the occasion were Dean Leland, Prof. Kirk, who knows everybody, and the "Little Colonel"—Ernie Jewett, president of the Society. Dean Leland and Prof. Kirk contributed many valuable suggestions for the conduct of the life of both Freshmen and upper-classmen. We all learned many things concerning methods of study and methods of recreation, and the upper-classmen were the objectives of many well-deserved criticisms and bits of sarcasm.

"Prexy" Jewett told us of the new "little brother" movement which has been started in the School of Chemistry.

The remainder of the evening was spent in card playing and smoking of the Camels donated by the Society.

Little Brothers

No, the School of Chemistry has not become an orphan asylum or kindergarten. The Little Brother movement you have heard so much about has nothing to do with such things.

The guiding lights of the newly-formed Student Chemical Society were suddenly struck with the idea that the Big Sister idea need not be restricted to the fair sex. Indeed, the freshmen of the less deadly species need a little advice from older and perhaps wiser heads just as much as the freshwomen. Thus it is that each Senior in the School of Chemistry has one or more Little Brother to care for and look after during the coming year.

To some of us, the need of this movement may not be apparent. However, a little study of the "mortality" rate among Freshman chemists will disclose startling facts. When a class of 65 or 70 Freshmen dwindles to a class of 20 or so Sophomores, it becomes apparent that the life of a Freshman does not always end happily. True, some of those dropping out do so for financial reasons or other reasons not directly traceable to scholastic difficulties; but I believe it may be safely said that 75% of the failures to return to school, and certainly all of the cases of Freshmen being dropped, are due to these difficulties. All must agree that those who have survived are able to offer suggestions that will aid those following to tread the path with more success.

These are the reasons for the Little Brother movement. The end of the first 6 weeks—midquarter—will show the first results of its endeavors.

Co-operation always helps. Won't every Freshman and Senior do his best to further this worthy and necessary cause?

C. W. Pearson, University of Minnesota, '22, having completed the Students' Training Course at the Schenectady Works of the General Electric Company, has been transferred to the Philadelphia office of the company, where he is engaged in engineering

COMPLETION OF SWEDISH NORTH-SOUTH RAILWAY

The most important railway development in Sweden last year was the opening of a connecting railway, 64 miles in length, affording through rail communication between Vilhelmina, in Southern Lapland, and Lake Vener, a distance of 461 miles. The new section connects with the North West Trunk line of the State Railways.

Railway electrification also made considerable progress in Sweden during 1922. Early in the year 173 miles of the Lapland Ore Railway were electrified. In March, 13 additional miles were converted and the electrification of the remainder of the main line (Riksgransen to Lulea) was completed at the end of June. The total length of line electrified is 271 miles. The lines to the ore mines, shunting yards, etc., are now being electrified, also the section of the Lapland Ore Railway in Norway.

The Lapland Ore Railway had 41 electric locomotives at the end of 1922, whilst 9 more of the most powerful type are to be delivered this year.—The Railway Engineer.

RALPH HAMMETT TEACHES DESIGN AT WASHINGTON U

Ralph W. Hammett, a former instructor in architecture at the University of Minnesota and well known in the architectural profession in the Twin Cities, has been appointed an assistant professor in the University of Washington, located at Seattle. He will teach advanced architectural design. Mr. Hammett assumed his duties late in September.

A Mankato man, Mr. Hammett was graduated in architecture from the U. of M. in 1919. Subsequently he was employed in architectural offices in St. Paul and Minneapolis, served two years as instructor at the school from which he was graduated, then took advantage of a scholarship at Harvard University, which he was awarded on his Minnesota record. At Harvard, Mr. Hammett obtained the degree of Master in Architecture.

PAINTING 416-MILE STRIPE

Paint a stripe 4 inches wide and 2,196,480 feet long down the exact center—was the order given a special crew started out this week by the Minnesota highway department. The stripe will be the "center line" on 416 miles of paving on the trunk highway system, to help drivers keep on the right side.

A rebuilt war truck has been especially equipped for the marking work. The paint feeds on a rubber-tired wheel which applies it to the pavement—white paint on black pavement and black paint on concrete. It is expected that the crew will mark about 25 miles a day.

ELECTRICAL EQUIPMENT ORDERS FOR JAPAN EXCEED $1,000,000

The Westinghouse Electric International Co. has received orders for electrical apparatus to be used in reconstruction work in Japan totaling well over $1,000,000. Other orders are in course of negotiation which will bring the total amount to approximately $2,000,000. It is understood that the power plants in the quake zone were not seriously damaged but that the distribution systems were practically destroyed.—Engineering News-Record.

TECHNICALITIES

ARCH. CHEM. ENGINEERING

TRY THIS ON YOUR CHIEF DONATOR, YOU GOLF FIENDS

Dear Dad:

The Math Course here is pretty hazardous, the best I could make was 95. That is pretty rotten, I know, but you might be pleased to know that I made the Chem., Drawing and Railroads courses in less than 60. I think I can reduce them if you will send me more money for clubs.

WHICH PROF IS THIS?

1st Stewd: Holy Cow, that prof surely talks a lung off a guy.

2nd Stewd: What does he talk about?

1st Stewd: He doesn't say.

A couple of the gang were talking in the back of the room discussing the difficulty of hitting a target with an Army 45.

Gunman: One would do well to hit the professor from here with a .45.

Tau Bete: He would do good to hit this one.

Mr. Boon (in railroads class): In Australia there is a tangent 300 miles long.

Sprehn (after much thought): Why didn't they run a straight track.

CONSIDER THIS, YE PLANNERS

Faulty Architecture

By Ella A. Fanning

They've built a bungalow so wee;
Its sun parlor is cute and bright,
The kitchenette is 5 x 3,
The neat garage is snug and tight.

Their means allowed a floor lamp gay,
Some period furniture, all good,
A big Victrola (weekly pay),
A radio set. (That's understood!)

He has a den, a shower, too;
A niche for golf sticks, shown with pride.
But—not one closet is in view,
Where fam'ly skeletons may hide!

SOME OF OUR GRADS

A witness was testifying in a case concerning cubic measure, but it was evident from his loose, vague talk that he didn't know exactly what cubic measure was. The Judge, to test him, said:

"Now, friend, look at this inkstand. Let us assume that this inkstand is one yard across the top this way, and one yard across the top that way, and one yard deep, how would you then describe it?"

The witness chuckled.

"I'd say, Judge, she was some inkstand."—Los Angeles Times.

Have you heard of the absentminded Prof. who poured cream on his head

MENTAL TELEPATHY?

The conjurer stepped forward to the front of the stage and said: "Ladies and gentlemen, if there is any young man in this audience who would like to know the name of his future wife, if that young man will kindly stand up, I will undertake to tell him."

Up jumped a young man.

"Thank you," said the conjurer. "Now, I always like to do business in a proper business fashion. Will you kindly tell me your name?"

"Certainly," said the young man. "My name is James Jackson."

"Thank you," replied the conjurer. "The name of your future wife will be Mrs. Jackson."

LOST IN TRANSIT

The old deacon had been a rugged old rascal as well as a general favorite in the community and the announcement of his illness created something of a sensation in the little village.

So numerous were the anxious inquiries regarding his condition that the attending physician advised that hourly bulletins be posted on the post office bulletin board. The first one read:

"10:00 A. M.—Deacon Jones seriously ill. Relatives sent for.

"11:00 A. M.—Deacon Jones sinking."

"12:00 M.—Deacon Jones no better.

"1:00 P. M.—Deacon Jones unconscious.

"2:00 P. M.—Deacon Jones still unconscious. Doctor declares recovery doubtful.

"3:00 P. M.—Deacon Jones sinking rapidly. End is near.

"4:00 P. M.—Deacon Jones is dead and gone to Heaven."

The little throng dispersed and when a Boston "drummer" tried, at 5:00 P. M., to purchase a stamp for cash, with no one to wait upon his wants, he couldn't resist the opportunity to help the good Deacon's cause along, by adding:

"5:10 P. M.—Great excitement in Heaven. Deacon Jones not arrived yet."

I'LL BITE! WHY?

Higgs—Big Jake, the bootlegger, got arrested yesterday.

Biggs—What for?

The newspaperman was interviewing the town's most prominent business man. "How long have you been in business?" he asked.

"Vell," said Mr. Ivonovith, "I was born in 1880."

"I shouldn't have eaten that mission steak,"
Said the cannibal king with a frown,
"For oft I've heard the old proverb:

ONE TOO MANY

"You love my daughter?" said the old man.

"Love her," he exclaimed, passionately. "Why, I would die for her. For one soft glance from those sweet eyes I would hurl myself from yonder cliff and perish—a bruised mass upon the rocks two hundred feet below."

The old man shook his head. "I'm something of a liar myself," he said, "and one is enough for a small family like mine."

—London Tit-Bits.

She—Why did we come out here?

He—To look at the moon.

"Then let's go back and dance."

—Cornell Widow.

A Scotchman came upon an automobile overturned at a railway crossing. Beside it lay a man all smashed up.

"Get a doctor," he moaned.

"Did the train hit you?" asked the Scotchman.

"Yes, yes; get a doctor."

"Has the claim agent been here yet?"

"No, no; please get a doctor."

"Move over, you," said the Scot, "till I lie down beside you."

Suggested slogan for one of our well known popular magazines: "All the nudes that's fit to print."

—Judge.

Abie (rummaging frantically through the desk): "Fader, Fader, tomorrow the fire insurance runs out!"

Fader: "Chas, und tomorrow dose fire depardment runs out"—and he immediately refilled the fire extinguishers with gasoline.

CHECK PROFS

Profs is those which:

Talksodamnedfastthatyoucan'ttakeanote.

Spend three-quarters of an hour and one box of chalk explaining, and then after you've copied four pages of notes, tell you that the stuff is not important.

Wear red neckties and horse collars.

Wait until you're jammed with work and then throw a quiz.

Think that their course is the only important one that you are taking, and hand out problems as if they were giving away German marks.

Tell you not to bone for the exam because it will be general, and then ask you if you agree with the statement on page 247.

Give you the Fs and the others the Cs and Bs.

Call the roll the day you cut.

—Mass. Tech. Voo Doo.

She—I hear he drinks something awful!

He—Yeah, I tasted it.

OLD, BUT GOOD

Here is a fairly old story which has recently had a revival in New York. It concerns two cloak and suit manufacturers who were sitting in a hotel lobby on Broadway. They intended to go to a theatre later and were killing time listening to a little free music from the dining room, when a dope peddler dashed madly through the lobby pursued by a detective. The peddler dropped a cardboard box filled with cocaine as he ran, and the detective was in too much of a hurry to notice it, so that one of the cloak and suit manufacturers secured the evidence instead.

He opened the box carefully and examined the contents.

"Who would think that a crook would take a chance like that just for the sake of ganvering a little bicarbonate of soda," he remarked to his friend.

"That don't lok like bicarbonate of soda to me, Jake," he friend said. "It's talcum powder."

"What do you mean, talcum powder!" Jake retorted. "You always want to give people arguments, Louis. That's bicarbonate of soda, because if it would be talcum powder it would smell from roses or violets, ain't it?"

"Well, smelling is believing," Louis remarked, "so leave me smell it once."

Jake handed the box to Louis, who smelled it vigorously, not once but two or three times.

"Nu?" Jake asked. "Is it or ain't it talcum powder?"

But Louis made no reply. A dreamy look came into his eyes and he lounged back comfortably in his chair, still grasping the box of powder.

At last he spoke.

"Listen, Jake," he said, "I don't think I will be able to go with you to the theayter tonight. I am leaving at twelve o'clock for Mexico, where I am planning to buy up all the oil wells and also maybe a couple of diamond mines."

Jake suddenly began to suspect the contents of the box.

"Leave me smell that box once, too," he said, and after snatching it from Louis he inhaled its contents twice as vigorously as Louis had done. A few minutes elapsed and then Jake issued his ultimatum.

"Now you listen for a minute, Louis," he said impressively. "Forget about them Mexican oil wells and diamond mines, because you ain't going to buy them tonight or any other time."

"And why ain't I?" Louis demanded.

"Because," Jake said, with another sniff at the cardboard box, "I positively wouldn't sell them to you."

EXPERIMENT NO. 1

Frequency of Osculations

October 19, 1923

Object of this experiment:

To determine mathematically the derivation of the formula for the frequency of osculations on a moonlight night:

We are given two forces and a couple, self-excited, and connected in parallel.

According to the great Polish experimenter of note, Paderewski, we are told that like Poles repel each other while unlike Poles attract. This the scientific field, but experiments are being constantly performed to determine if this is really so, and to make sure that the rules haven't changed any.

During some experiments conducted at the Watertown Arsenal, it was found that of these two forces in question one was good intention and the other in compression. This only holds true, however, until the yield point is reached, after which both forces are in compression.

Of the several factors controlling the speed and frequency there are several which must be entered into the equation in order to insure the applicability of the rule.

The first of these is reactance, in which one of the forces is forward or backward, depending upon the capacity. There is a certain amount of friction, but this can be eliminated to a more or less degree if the impelling force is smooth enough. The resistance is also a variable quantity, being fairly high at the beginning and varying inversely with the temperature. The inertia depends entirely upon the mass and acceleration of the participants and therefore varies with the speed.

These forces of impedance we will group into one quantity which we will call LAG and will be expressed by the symbol L.

The next variable to be considered is the output factor. This is determined jointly by the windage, which varies as the speed; the leakage, which varies inversely with the speed, gradually approaching zero as a limit. The output is also governed somewhat by the armature curve or arm curvature as the later texts express it, but this depends in some measure as to whether we are concerned with a lap or butt joint.

All of these items compose the output coefficient, which we will express by the symbol O.

There is one factor which we have purposely omitted from the above which is hysteresis. This varies with the velocity times two, and represents the hangover from one osculation to the next. This we will express by the symbol V.

The last quantity entering into our equation is the temperature, which we will involve by the use of the coefficient of constant pressure, and express by the symbol E.

We now have our equation for frequency:

$$f = \int_{O}^{L} \text{LOVE}\, dv$$

(Experiment has justified "L" as the limit in most cases.)

which, when integrated, gives:

$$f = \frac{0}{2} V^2 + C$$

Now, if the moonlight is very weak there isn't any C, and the equation becomes:

f = Nothing divided by two, times both powers of their velocities.

In conclusion, however, it is generally conceded that the mathematical derivation at its best is more or less approximate, and the only true results can be obtained by experiment for each particular case.

Respectfully submitted.

NEVER LET YOUR STUDIES INTERFERE WITH YOUR EDUCATION

By E. D. K.

I learned about women from Hulda,
I learned about women from Prue;
Carmen and Marie and laughing Gabys
Were wise in what I never knew;
And yet I am ever acquiring
A bit of this great mystery—
Wherever I go each lass that I know
Is a new book of knowledge to me.

There is a young man in the official set in Washington who is wise beyond his years, as was evidenced when he paused before answering a widow who had asked him to guess her age.

"You must have some idea about it," she said, with what was intended for an arch sidewise glance.

"I have several ideas," said the wise young man, with a smile. "The only trouble is that I hesitate whether to make you ten years younger on account of your looks or ten years older on account of your brains."

Then, while the widow smiled and blushed, he took a graceful but speedy leave.

TRY THIS ON YOUR FAVORITE WINDJAMMER

Bishop Doane, of Albany, was at one time rector of an Episcopal church in Hartford, and Mark Twain, who occasionally attended his services, played a joke upon him, one Sunday.

"Dr. Doane," he said at the end of the service, "I enjoyed your sermon this morning. I welcomed it like an old friend. I have a book at home containing every word of it."

"You have not," said Dr. Doane.

"I have so."

"Well, send that book to me. I'd like to see it."

"I'll send it," the humorist replied. Next morning he sent an unabridged dictionary to the rector.

SOB SOLVENTS

May—"Why do you call that annoying sales-girl 'Iodine'?"

Mie—"Because she's a counter-irritant."

Diner—"Hey, waiter, what are these black specks in my grapefruit?"

Waiter (after a qualitative inspection)—"Say, Boss, dat must be some of dem vitamins dey all is talkin' about."

First Junior—"What are you taking now?"

Second Ditto—"The Chinaman's course."

Ditto One—"Huh?"

S. D.—"Iron and Steel."

It has been rumored that one of our professors, in giving a lecture on "How Far Is Up?" got his notes mixed and spoke on "The Simplicity of Integral Calculus." The Tau Bete's before whom he spoke voted the lecture, as given, the most clarifying explanation of this momentous question that they heard.

OUR LATEST SONG HITS

"She hangs out in our alley—but oh what she hangs out."

"The Eagle may be a wonderful bird, but it takes the Stork to deliver the goods."

"She had no mother to guide her so

HIGH TENSION IGNITION SYSTEMS

(Continued from page 10)

tional energy dissipated in the gap during Period four as a result of the rotation of the armature is not present in the case of battery systems and hence for battery systems the total spark energy is less than for magnetos.

The first high tension ignition system consisted of an induction coil equipped with a trembler vibrator, a battery and some form of low tension distributor. These systems gave an endless amount of trouble, one of the principal sources of trouble was the proper maintenance of the battery. In the midst of all the troubles connected with the trembler coil ignition system came the introduction of the modern high tension magneto which almost universally displaced the trembler coil as a means of ignition. With the advent of electric lighting and starting on motor cars the battery ignition system was again brought out although in a somewhat modified form from the earlier battery systems. The essential difference is that the trembler vibrator has been replaced by a breaker similar to that used on the high tension magneto. The battery system is almost universally used on pleasure cars in America while the high tension magneto is extensively used for ignition on trucks, tractors and aeroplanes. The general substitution of battery ignition systems for the high tension magneto on pleasure cars in America has resulted in some argument as to the advantages which one system has over the other and it will not be amiss to point out the inherent characteristics of both.

A good way to compare battery ignition systems and the high tension magneto is from the standpoint of current at break and total spark energy. The curves of Fig. 4 show, in general, the relation between the current at the opening of the breaker and the rate of sparking or speed for battery systems and high tension magnetos. These curves show that the current at break for a battery system is nearly a maximum at zero speed and decreases with speed, while in the case of a high tension magneto the current at break is zero at zero speed and increases rapidly with an increase in speed until at a fairly high speed it is about independent of the sparks per minute or speed. The curves of Fig. 5 indicate the relation between the total energy per spark and sparking rate for battery systems and high tension magnetos. Thus for battery systems the total energy per spark is a maximum at zero speed and decreases with an increase in the sparking rate. For a high tension magneto the total spark energy is zero at zero rate of sparking and rises rapidly to a maximum at a moderate speed, thereafter declining as the rate of sparking is increased. Since the induced secondary voltage is

$E = I\sqrt{\frac{L}{C}}$, i. e., varies directly with the current at

break, and since for battery systems the current at break is nearly a maximum at zero speed, see Fig 4, the induced secondary voltage will be a maximum at zero or low speeds. In the case of the high tension magneto the current at break is a minimum at low speeds and consequently the induced secondary voltage will be a minimum at low speeds. If the characteristics of a battery ignition system and a high tension magneto are such that the same current at break will induce the same voltage in the secondary of either the battery coil or the high tension magneto, the curves of Fig. 4 show that before the induced voltage of the magneto can exceed that of the battery coil the magneto will have to be operating at a fairly moderate speed. With an increase in speed the magneto will give a greater induced voltage while the induced voltage of the battery coil will decrease as the current at break decreases. Hence the battery system possesses ideal cranking characteristics from the standpoint of high voltage and high total spark energy at low speeds while at the higher or normal operating speeds the magneto is superior. In the statement that high total spark energy is desirable it is not intended to convey the meaning that high energy per spark indicates high igniting power but rather that high spark energy indicates ability to produce a spark under unfavorable plug conditions.

The breakdown voltage of the spark gaps used for ignition purposes is extremely variable and subject to several factors. The factors which affect the breakdown voltage of a gap are:

1. Steepness of wave front of applied voltage.
2. Temperature, pressure and nature of the gaseous medium.
3. Shape of electrodes and polarity of gap.
4. Turbulence of gaseous medium.

These factors will be discussed briefly in the order given above.

1. Steepness of wave front of applied voltage.

The steepness of wave front or rate of application of voltage to a gap has a considerable influence upon the voltage which must be applied to a gap before it will fire. In Fig. 6 let the abscissa represent time and the ordinates voltage. Assume that we have a given gap and two sources of voltage, one whose wave form is like that of Wave 1, Fig. 6, and the other which gives a wave form like that of Wave 2. Let the source of voltage whose wave form is like Wave 2 (sine wave) be connected to the gap and assume that the gap fires at a voltage, E_2, after a time, T_2, has elapsed. Next, if the gap is connected to the source of voltage of wave form similar to Wave 1, but of much steeper wave front than Wave 2, the gap will not fire at a voltage, E_2, but at a much greater voltage, E_1, after an elapsed time, T_1. The wave front of the voltage given by a high tension ignition system is on the order of Wave 1, Fig. 6, which is much steeper than the wave front of the usual alternating voltage. Hence a gap which will fire at a certain value of alternating voltage will not fire at the same voltage when a voltage wave of steeper wave front is impressed upon it. The ratio of the two voltages, $\frac{E_1}{E_2}$, has been termed by Peek[16] the "impulse ratio." A third point or "teaser electrode" arranged near one of the gap electrodes will reduce the impulse ratio but it will not be unity. The usual spark plug gap has an impulse ratio somewhat greater than unity.

2. Temperature, pressure and nature of the gaseous medium.

The results of tests[5] made at the Bureau of Standards indicate that the breakdown voltage of a gap is affected by changes in temperature and pressure only to the extent that the density is affected, i. e., heating a gas at constant volume does not change the sparking voltage. The breakdown voltage of a

(Continued on page 26)

(Continued from page 24)

gap will depend upon the gas which surrounds the gap. The usual tests of gaps are made in air but under actual operating conditions ignition gaps work in a mixture of air and gasoline vapor. It has been found experimentally that the breakdown voltage of a gap in gasoline vapor and air is less than in air. The Bureau of Standards state in one of their reports[8] that the sparking voltage of a gap in an explosive mixture of air and gasoline vapor is about 10% less than in pure air. Patterson and Campbell[23] state that the sparking voltage is less in a mixture of air and gasoline vapor than it is in pure air and give an equation showing the relation.

3. Shape of electrodes and polarity of gap.

The electrode shape of a gap or "geometry of spark plugs" will affect the breakdown voltage of a gap. Gaps may be termed "fast" and "slow" and in general the usual spark plug gap is a slow gap. An annular gap has a fairly low impulse ratio but it is not unity. The results of a rather extensive series of tests on spark plug gaps made by Young and Warren[18] indicate that the sparking voltage may vary considerably with the shape of the electrodes and the direction of current through the gap. Some of the plugs which they tested were fitted with slightly different annular gaps and their results show that for an annular gap the sparking voltage is independent of the direction of current through the gap but the impulse ratio is not unity.

4. Turbulence of the gaseous medium.

The turbulence of the gaseous medium will affect the sparking voltage of a gap but the degree of turbulence cannot be readily expressed. Perhaps the most satisfactory way to express turbulence is in terms of the velocity of an air stream projected at right angles to the spark. This is the method which Young and Warren[18] used and they found that the sparking voltage increased with an increase in velocity of the air stream. The degree to which turbulence will affect the sparking voltage will also depend upon the amount of shielding which the construction of the plug may afford.

In general it may be said that the breakdown voltage of a spark plug gap when in operation on an engine is less than it is when in air.

A convenient way to examine the characteristics of magneto spark discharges is by means of a rotary test gap which will draw the discharge out. The rotary test gap consists of a light piece of wood securely fastened to the shaft of the magneto driving motor. A wire is run up each side of the piece of wood and bent over at the end to form a gap. One of the wires is grounded to the shaft of the magneto to driving motor and the other wire is connected by means of a brush to the distributor of the magneto. If the magneto is a four-cylinder machine and all distributor points are connected so as to fire through the test gap there will be four discharges equally spaced around the circle swept out by the test gap. The effect of advancing or retarding the spark can be readily shown by this arrangement. A photograph of the discharge from one distributor point as drawn out by the rotary test gap is shown in Fig. 7. The discharge is from a Bosch magneto firing a ¼" test gap at a speed of 1,000 R. P. M. The radius of the test gap circle was 7¾". The time of exposure was 1/50 second and several be open for an appreciable time in order to get anything to show on the plate. The sequence of events is from left to right and at a, the bright, white line, which is the capacity component of the spark, is clearly shown. This corresponds to st of Fig. 2. The inductive component of the spark is shown along b. In the discharge drawn out by the test gap the inductive component appears as a series of violet lines and in addition a yellow band which extends from the capacity component a, to the extinction of the spark. The addition of capacity to the secondary will shorten the inductive component of the spark and if sufficient capacity is added the inductive component may be made to disappear almost entirely. No change in width of the brilliant white line, characteristic of the capacity component, was noticeable when sufficient capacity had been added to the secondary until the inductive component had almost disappeared, but the sound of the discharge changed from a hiss to a sharp, crackling noise. In the photograph a bright line which extends from the capacity component a, nearly to the end of the inductive component is noticeable at the upper gap electrode. This line photographs as a white line but when a visual observation of the discharge is made this line will appear as a violet line. If a machine which gives two sparks per revolution is discharging through the test gap this blue line will be found to occur on alternate electrodes of the test gap, which indicates that the discharge is unidirectional. Another interesting thing which the writer has observed on the rotary test gap is that the discharge does not occur in the same place at all times but the discharge as a whole oscillates slowly through an angle of several degrees. This is shown in Fig. 7, where two capacity discharges occurred later than the discharges at a. It is possible that the reason for this is due to a bouncing of the breaker points or a variation in the sparking voltage of the gap.

The oscillograms of Figs. 2 and 3 were taken with a General Electric oscillograph which is equipped with three elements or galvanometers. The oscillograph elements were fitted with standard suspension strips (.007" x .00075") and standard mirrors (.017" x .060"). The strip tension was increased from the normal tension of 4-6 ounces to 9-10 ounces, which was the maximum tension that the strips could stand for any length of time.

The vibrator which recorded the primary current was placed at b, Fig. 1, and the vibrator which recorded the secondary current was placed at a, Fig. 1. The oscillogram of Fig. 2 was taken on a K-W magneto operating at 1,720 R. P. M., at neutral spark advance and firing a ⅛" gap in air. The value of the primary capacity was .5 M. F. In Fig. 2 the breaker closes at m and as the armature rotates to the firing position the current builds up to n, where the breaker opens. Shortly after the breaker opens the gap breaks down at s and a ballistic throw of the galvanometer in the secondary circuit to t follows. As nearly as can be determined from the oscillogram n and s occur simultaneously. The rate of change of current shortly after the breaker opens is enormous and hence conditions are favorable for the production of a high voltage in the secondary. About at z the inductive component commences and continues to y, the extinction of the spark. Note the surge at c as the spark is extinguished.

The magneto on which the oscillogram, Fig. 2, was taken is of the inductor type and gives four flux reversals per revolution, hence four sparks per revolution may be obtained from this machine. The machine from which Fig. 2 was obtained had a cam that opened the breaker twice per revolution, which left two flux reversals unused. The slight surge shown at a is due to the generation of a small current in the circuit consisting of the primary winding and condenser in parallel as the armature passed through the unused flux reversals.

The curves at the extreme right of Fig. 2 are interesting as they show bouncing of the breaker contacts. After the breaker opened at n the primary current commenced to flow into the condenser to f when the breaker closed again. After the breaker closed at f the primary current was restored to its original value at g. In the meantime when the breaker opened at n, the gap commenced to discharge at i but the closing of the breaker at f extinguished the spark and the gap current decreased to s. After the breaker opened a second time at g the gap fired again, commencing at s. The remainder of the discharge is the same as the two preceding discharges with the exception that the throw of the galvanometer st, and the value of the current reached at o are less in the discharge at the extreme right of Fig. 2 than they are in the preceding discharges of Fig. 2.

The oscillogram of Fig. 3 was taken on a Heinz magneto operating at a speed of 1,005 R. P. M. at full advance and firing a ⅛" gap in air. The value of the added secondary capacity was 295 M. M. F. This oscillogram is interesting as it shows different positive and negative sparks. In the discharge pictured at the right of Fig. 3 the spark was extinguished by the closing of the primary breaker, that is before all the energy available in the secondary had been dissipated in the gap. On the other hand the spark at the left in Fig. 3, of opposite polarity than the spark at the right, shows practically a linear decrease of gap current from the inception of Period four to the end. Perhaps the reason for unequal positive and negative sparks is that the machine is unsymmetrical.

In concluding this article it will perhaps be appropriate to call attention to a device which is claimed will reduce ignition troubles to a minimum. The device, which it is intended to discuss briefly, is the series spark gap.

The series or subsidiary gap is merely a spark gap in some form or another which is placed in series with the high-tension side of a spark plug. The trade name under which these devices are sold may be anything but a spark gap such as "Electroscope," "Dynamizer," etc. Many extraordinary claims as to what these devices will accomplish are advanced, and if they were only true the millennium is at hand, as far as ignition troubles and the operation of internal combustion engines are concerned.

If a spark plug is fouled the insulation resistance is low and a fouled plug may be regarded as a spark gap shunted by a certain value of resistance. Under ideal operating conditions, i. e., clean plugs, after the breaker has opened a charging current flows into the capacity associated with the secondary. If the plug is fouled a portion of this charging current flows through the fouling resistance and hence the value of the maximum available voltage will be decreased. Before the plug can fire the IR drop across this fouling resistance must be equal to or greater than the breakdown voltage of the gap.

The addition of a small series gap in series with the plug will increase the IR drop across the plug and under certain conditions may result in the firing of a fouled plug which would not fire otherwise. After the breaker opens the secondary voltage rises and when it reaches the sparking voltage of the series gap this gap discharges. As a result of the discharge of the series gap the voltage across the plug rises to a certain value and if it is equal to or greater than the sparking voltage the plug will fire, otherwise it will not fire. If the resistance of the fouling is sufficiently low it will not be possible to fire the plug.

One of the claims advanced for series gaps is that they will fire any plug regardless of the value of the fouling resistance. Such a claim is obviously not true since if the fouling resistance is sufficiently low the plug cannot be fired even if the series gap is in circuit. On the other hand by the use of a series gap it is possible to fire a fouled plug which could not be fired if the series gap was not in circuit.

Another advantage claimed for series gaps is that they reduce the consumption of gasoline. The explanation for this claim is that directions for the use of series gaps usually state that a different carbureter adjustment is necessary when they are used. Many cars operate on too rich a mixture and the same economy in gasoline consumption which series gaps apparently show can be effected by a readjustment of the carbureter at any time, regardless of the presence or absence of the series gap. For a more extended discussion of series gaps the reader is referred to a Bureau of Standards[11] report.

To Prof. F. W. Springer, who has published considerable material on ignition and who placed at the disposal of the writer all his notes on the subject, the writer expresses his thanks.

Bibliography

1. Springer: Electrical World 48:995, 1111, 1242.
2. Springer: Electrical World 50:1163 (Dec. 14, 1907).
3. Springer: Electrical World 51:343, 387.
4. Springer: Electrical World 53:1587.
5. Silsbee: U. S. Bureau of Standards Scientific Paper No. 424.
6. Silsbee: U. S. Bureau of Standards N. A. C. A. Report No. 123.
7. U. S. Bureau of Standards: Aer. Power Plant Report No. 13.
8. U. S. Bureau of Standards: Aer. Power Plant Report No. 14.
9. U. S. Bureau of Standards: Aer. Power Plant Report No. 15.
10. U. S. Bureau of Standards: Aer. Power Plant Report No. 16.
11. U. S. Bureau of Standards: Aer. Power Plant Report No. 18.
12. U. S. Bureau of Standards: Aer. Power Plant Report No. 20.
13. U. S. Bureau of Standards: Aer. Power Plant Report No. 28.
14. U. S. Bureau of Standards: Aer. Power Plant Report No. 31.
15. Jones: Philosophical Magazine 36:145 (1918).
16. Young and Warren: Sparking Plugs.
17. Armagat: Electrician 76:865-899.
18. Young: Automobile Engineer March, 1915.
19. Peek: Dielectric Phenomena in High Voltage Engineering.
20. Morgan: Electric Spark Ignition.
21. Campbell: Philosophical Magazine Vol. 38 Aug., 1919.
22. Morgan: Philosophical Magazine 41:462.
23. Patterson and Campbell: Proc. Phys. Soc. Vol. 31 June 15, 1919.
24. Clough: Horseless Age Apr. 8, 1914.

HO HUM—THAT CIVIL CAMP AGAIN

(Continued from page 6)

broad statement. The line was equipped with three Fords. Carl Erickson and Roscoe Bauer piloted the famous "Red Lantern," so named because of a red signal lantern which hung on the rear of the car. This lantern, along with a pike pole, two famous hats, a pitchfork, and the Plumb Bob, is on exhibition in the senior room. As far as the records show, the "Red Lantern" was the only car in camp claiming the distinction of an encounter with "Bill," the Cass Lake police force. The "Red Lantern" toured the country far and wide, even being seen in Canada. No, they did not bring anything back.

George Bestor piloted the only ten-passenger coupe in existence. It sure takes some piling to pilot a Ford Coupe under ten men. This is the car by which all advertising of the great coming event, the Engineers' Dance, was circulated.

The third bus was a corporation owned car. Of this one we have not much knowledge since it ran only when forced to by the combined efforts of its five owners, Bob Parker, R. V. Lund, Bill Frantz, Reuben Gustafson and Art Tews. Great bus service was rendered by Mr. Cutler and Mr. Zelener in taking parties to and from distant locations.

Bill, our camp chef, said he could not shout as loud as he had in years gone by. We believe that is true, his voice only carries about a mile or two now. The length of the camp was nearly 300 feet. In order to wake the boys in the far end of camp, he was provided with a camp horn. This horn is five feet long and with Bill at the mouth-piece we will back the combination against any fog horn yet invented. One day a fair visitor at camp spied him as he took the horn from its corner in the kitchen. She immediately became interested in the procedure and stepped up closer to get a better view. Bill took a deep breath in preparation for the mighty blast. He carefully adjusted the mouth-piece to his lips and blew. What now, a faint murmur is all the horn will produce. Amid much laughter and advice from the boys, and a faint smile from a fair one, he once more put forth his entire efforts, but in vain. A close examination made through the bell of the horn showed a towel doing duty as a mute. After some deliberation, it was concluded that "Spike" Garzon was the guilty party. ("Spike" was often seen around the kitchen and he did not lose any weight at camp.) Bill became so firm in his convictions that a couple of nights later, while the boys were playing for a dance in town, he sewed the blankets of "Spike's" bed in such a manner that considerable time was spent in getting into bed that morning.

There is one thing about living at Cass Lake—it teaches a person to appreciate Minneapolis. After six weeks in camp we were all ready to go home. We were tired of doing our own washings, of shaving and bathing in cold water, of eating camp grub. Sprehn went so far as to state that one of the first things he would want when he got home would be a good home-cooked meal. There was no note of regret as we tore down our tents, burned our furniture, and packed up for the return trip.

But it is a human frailty always to wish to be some place other than where you are. Now that it's over, we may all find that we brought back many

(Continued on page 32)

(Continued from page 30)

pleasant memories from Cass Lake, memories of the camp, the village and the village flappers. In years to come, Sprehn will remember with pleasure the four queens he held against a pot full, Nyvall will look back gratefully upon his fortunate escape from the wildcats at Doanful Inn. Time may come when some of us wish we were back there, not for six weeks but say six hours, from eight P. M. to two A. M. with a rendezvous at the Coffee Shop and a ride home in the ten-passenger coupe to wind up the evening.

ELECTRICAL ALUMNI MAKE GOOD

(Continued from page 12)

sales managers, grain operators, brokers, city engineers, exporters, automobile representatives, engineers and operators of radio broadcast stations, real estate promoters, farmers and others—all of these are graduates of the electrical engineering department of the College of Engineering and Architecture of the University of Minnesota. Indeed, we have cause to be proud of the accomplishments of our electrical engineering department under the capable leadership of Professor Shepardson.

THE FRESHMAN-SOPHOMORE SCRAP

(Continued from page 12)

again, past Folwell Hall and up onto the Campus Knoll. It finally broke up in front of the P. O., where more cheers were given.

Not content with winning their own scrap, the Engineers proceeded to break up the Academic "Ten-party" and run off with the raid bags for which the Academics had been fighting. All during the afternoon the Engineers continued their celebration with occasional yells or wild demonstrations of various sorts.

As a final climax to scrap day, all the Engineers assembled at the Gayety, where they proceeded to pull the place to pieces and put it up to suit themselves. A parade after the show completed the day's activities.

THE STAFF SAYS:

Our advertisers advertise for two reasons:

1. Because they want the Techno-Log to succeed.
2. Because they believe the Techno-Log advertising pays.

Their good will is assured us—they gave us that. Whether or not they give us ads depends on the business we find for them. That depends on you.

When you see an advertiser, tell him you saw his ad in the TECHNO-LOG. He will like it and so will you. You boost his business and your college.

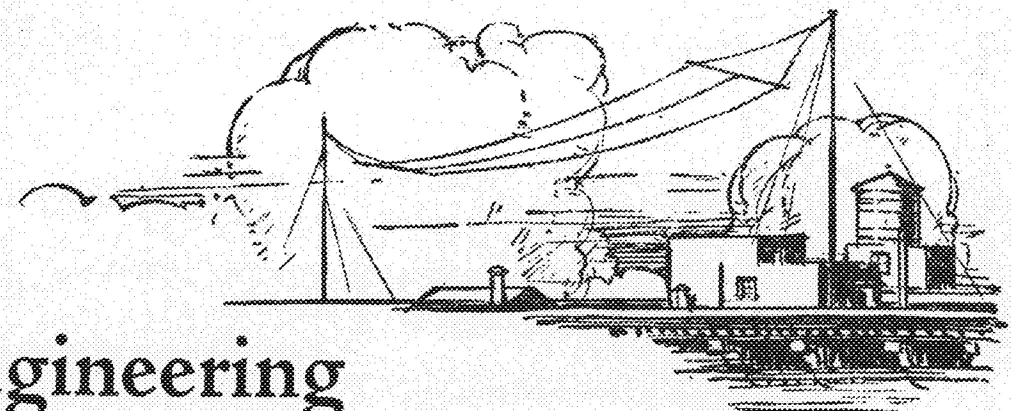
MINNESOTA TECHNO-LOG

VOL. IV. NO. 2 DECEMBER 1923

Published Monthly During the School Year
by the Students of the College of Engineering
and Architecture, School of Chemistry
and School of Mines of
the University of
Minnesota

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

© O. E. CO.



What Engineering Owes to the Imagination

From An Argument Over Watches Came KDKA

BACK in the days when wireless was just beginning to spread, Frank Conrad (now Assistant Chief Engineer of the Westinghouse Electric & Manufacturing Company) and another official, happened to compare watches, to see if it was time to go back to work. Their watches differed.

Unable to convince his friend that his watch was right, Mr. Conrad suddenly remembered that the naval station at Arlington, Va., had just inaugurated a system for sending out daily time signals by radio. Just the thing to prove his point!

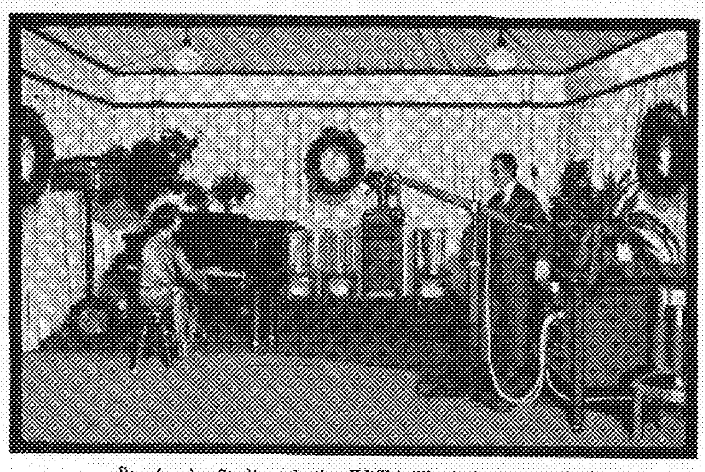
So he built a simple set of receiving apparatus, erected an aerial, and—you can imagine what happened! He was badly bitten by the radio bug. After proving to his satisfaction the accuracy of his watch, he started experimenting with the transmission of music by radio, with good success.

He began sending out phonograph music from his home, and attracted the attention of some of the big department stores, that had installed radio departments. They in turn, started advertising Mr. Conrad's "musical evenings."

Then, one day, upon arriving at his desk, he was summoned to the office of Harry Phillips Davis, Vice President of the company.

"Frank," said Mr. Davis, "I'm going to close your radio station." His attention had been attracted the night before to a simple note in a full-page advertisement, which read, "Mr. Conrad will send out phonograph music this evening."

You know the rest. In November, 1920, "KDKA" was formally opened to send out election returns. It had received the first license issued by Uncle Sam. Today over 500 broadcasting stations entertain and educate millions of people each night, a wonderful result from so insignificant an argument as one over watches.



Broadcasting Studio at Station KDKA, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

Westinghouse

WESTINGHOUSE ELECTRIC

ACHIEVEMENT & OPPORTUNITY

INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

Published and Copyrighted Monthly by

The Engineering Students
of the
University of Minnesota

Main Engineering Building, Minneapolis, Minn.

Subscription $1.50 per year — Twenty-five Cents the Copy

VOLUME IV — DECEMBER 1923 — NUMBER 2

TABLE OF CONTENTS

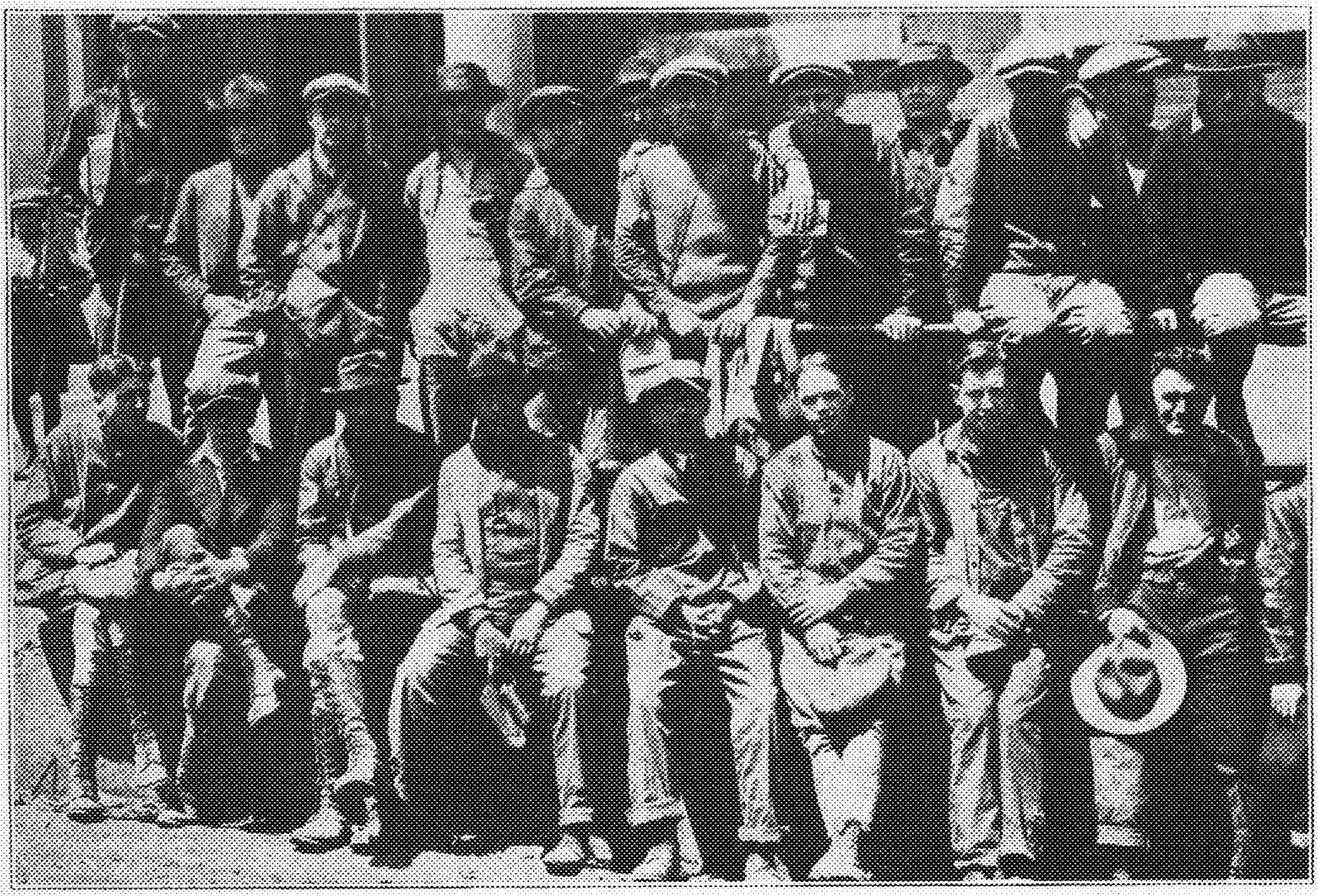
MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

The Cornell Civil Engineer
The Transit
Iowa Engineer
Colorado Engineer
Nebraska Blue Print
Penn State Engineer
Sibley Journal of Engineering
Rose Technic
Michigan Technic
Minnesota Techno-Log
Virginia Journal of Engineering
Ohio State Engineer
The Towne Scientific Journal
Wisconsin Engineer
Illinois Technograph
Tech. Engineering News
Kansas State Engineer
Princeton E. A. News Letter
Kansas Engineer

MINNESOTA TECHNO-LOG

University of Minnesota

VOLUME IV | DECEMBER, 1923 | NUMBER 2



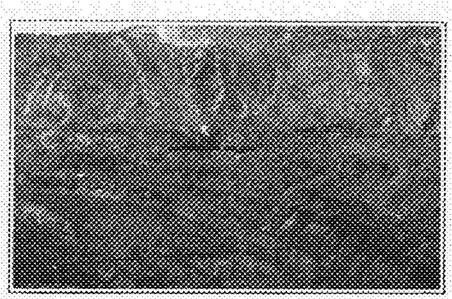
OUR MINERS TOUR THE WEST

Twenty-six Days Spent on Inspection During Which Duty Often Interfers With Pleasure

By L. M. Case, M. '24

THE field work conducted by the School of Mines consists of two trips: one at the end of the Sophomore year and the other at the close of the Junior year. The work of the Sophomore expedition is always given on the Minnesota iron ranges. The Junior trip covers more territory and usually takes in several of the large western mining and smelting districts. Last spring we were very fortunate as the faculty chose Colorado Springs and the Salt Lake District for our sightseeing expedition.

After the usual scramble and "cramming" to attain the necessary scholastic requirements, twenty-one Juniors were declared eligible and on the evening of May 4 embarked on the Rock Island road for Colorado Springs. By previous arrangement with the railroad, we were given a special car. This was at first considered by us to be a great favor but as the trip progressed, it became fairly evident that our confinement to one coach was a diplomatic move on the part of the passenger agent. However, we arrived in Colorado Springs Sunday morning, somewhat tired and dusty, but with all railroad equipment intact.



Open-Pit Copper Mine

Our technical achievements at the Springs consisted of a general and more or less detailed inspection of the Golden Cycle Company's cyanide plant, and the Pike's View Coal Mining Company's property. Every courtesy possible was extended to our party while in these plants and the managements went to great care and expense in explaining their operations.

Our idle hours were spent in sightseeing, said activities being greatly aided by the owner of the bus line, who never failed to suggest a trip to some place of unexcelled beauty and scenic wonder, even surpassing the trip taken the evening before. But it was all new to us and we were enabled to see most of the important points of interest due to his suggestions, so his efforts were appreciated even at a dollar a throw.

Wednesday morning, May 9, we again took to the railroad, a la special car, and proceeded to Salt Lake City, Utah. By this time our singers were beginning to get together. The passengers showed considerable interest in our repertoire, especially the "One-eyed Riley" and "Kipling's Ladies." We let everyone know where we were from, however, by using the "Rouser" and "Minnesota, Hail to Thee." The trip to Salt Lake City through the Royal Gorge is one which will not soon be forgotten, as there are few routes surpass it in scenic beauty. The open observation car offered a wonderful opportunity to gaze, and thanks to the two "news-butchers" who sold us the goggles (guaranteed to keep the cinders and dust out of one's eyes), we collected more than our share of the cinders. These gentlemen also had a most wonderful collection of tourist literature which they were disposing of at sacrifice prices and nearly everyone bit. On arriving at Salt Lake, Elmer Jones was nearly apprehended in the act of confiscating a vital part of the equipment of the railroad. The article consisted of a car coupler and nearly broke the handles off his bag.

Upper Left—Bingham, Utah
Lower—Tintic Standard Mine at Dividend, Utah

Salt Lake City was our headquarters for nearly a week and provided ample opportunity for the boys to get acquainted. It was the consensus of opinion that we could have had a much better time, socially, without the watchful eye and guidance of Professors Pease, Parker, and Comstock in this fair city. However, the "bosses" usually retired early and missed most of the fun. The only thing in Salt Lake which seemed to be open to criticism was the street car system, which ceased operations at midnight, and was the cause of many long walks in the "wee" small hours. It might be well to explain that this city is infested with the gentler sex to such an extent that it was almost necessary to carry a club to fight them off. Regardless of this handicap we managed to have a good time and more than enjoyed ourselves. Through the efforts of several School of Mines students from the University of Utah, our party enjoyed visits to their campus and to the various chapter houses. A number of the boys, being furnished with partners, cars, tickets and programs, attended the annual Sophomore dance given on their campus. The Utah men were royal entertainers and are to be commended for their spirit.

As usual, our technical duties interfered with our activities, even in such a fertile locality. Trips were made to Bingham, Garfield, Magna, Arthur and Murry. The town of Bingham is one of the picturesque mining camps of the west. Situated in a steep mountain canyon, the town is eight miles long and scarcely one hundred feet wide at the widest part. At some places there is not room for houses on both sides of its one street, which is comparable, in width, to some of the thoroughfares of our sister city, St. Paul. Only the most powerful cars can attain the far end of town and it is a question as to how some of the heavy mining machinery was transported to the mines. The mail man delivers the mail on horseback and the poor steed was anything but the dashing Indian pony of the open range when we saw him near the head of the canyon.

Through the efforts of Professor Comstock, we got our lunches at a company boarding house, thus depriving us of the usual excuse for being late in the morning. The Salt Lake waitresses were very accommodating in that respect as no one ever was able to get a lunch put up on time. It was here that our own Bob Persons nearly broke into print through the efforts of the editor of the Bingham newspaper. But the editor was evidently a couple of drinks ahead when he interviewed Bob so we don't know yet who the joke is on.

Some of the largest copper producing mines in the world were visited in Bingham, where the mining is carried on by open-pit methods, with steam shovels, somewhat similar to the Mesabi iron mining. As the ore is in the form of a mountain, the mining was more aptly described by Professor Comstock as "open pit methods—wrong side out." The Utah Copper Company which controls and operates the mine furnished part of their engineering force to show us over the property. These guides, however, couldn't seem to realize that we were not accustomed to the mile high altitude and nearly ruined the whole crew by their fast walking. But Professor Comstock was not any more acclimated than we were, so the laggards had company this time. In the afternoon we inspected the surface plant of the Highland Boy mine, where no one found a good place to sleep. Professor Comstock, about this time, developed a mania for collecting stray parts of air drills, which he distributed among different members of the party to be delivered to him on our return to town. The following day we returned to Bingham and went underground at the Highland Boy mine. Everyone was cold, wet and hungry when we got back on the surface late that afternoon and had just got a good start for the bus when Professor Comstock's inquisitiveness got the better of him. As a result we all had to stop and figure out the capacity of a fool aerial tram for him, and some of us missed our seats in the bus.

(Continued on page 30)

CIVILS HOLD IMPORTANT POSITIONS

Alumni of this Department, in Every Branch of the Field, Are Widely Scattered Throughout the World

By James M. Sutherland, '27

BACK in 1870, there was no College of Engineering in the University of Minnesota; it was only a part of the College of Agriculture and Mechanic Arts. However, in 1871, it became a separate college under Professor Arthur Beardsley. The college was composed of three parts: the Departments of Civil and Mechanical Engineering and the Department of Architecture. Its official name was the College of Mechanic Arts.

The first degrees in Civil Engineering were given in 1875 to H. C. Leonard, S. A. Rank and Clark Stewart. The faculty of the College of Mechanic Arts at that time was composed of Professors Thompson, Winchell, Rhame, Peckham, Marston and Peck.

The equipment of the Department of Civil Engineering in 1875 consisted of a good compass, a transit, a level and several lesser instruments. A "Y" level was procured the following year. Professor M. D. Rhame was Professor of Civil and Mechanical Engineering at that time.

In 1877, three more students received the degree of Bachelor of Civil Engineering. They were L. S. Gillette, E. A. Hendrickson and C. E. Thayer. W. S. Dawley and P. P. Furber received their degrees in 1880. Money for the construction of building to house the College of Mechanic Arts was appropriated by the State Legislature of 1881; but, because of a shortage of funds, construction was delayed. In 1882 the registration in the Civil Engineering Department had increased to five. No degrees were conferred from 1879 till 1883, when W. G. Peters and L. O. Smith were given theirs. During the same year, A. M. Holcomb was given a certificate in Civil Engineering for his thesis, "Iron Railway Bridge in Minneapolis."

Three new instructors, Decker, Waitt and Carr, were added to the faculty at this time, to accommodate the ever increasing number of students. In 1884, W. R. Hoag, I. W. Mathews and G. J. Loy were presented with their degrees.

At last, in 1886, the long delayed Mechanic Arts building was erected. This same building is today used by the School of Business. All of the Engineering departments were in this new building. In 1888 there were nine Civil Engineering students. Up to this time the College of Mechanic Arts was composed of juniors and seniors only, work in the Academic College being required before entrance. But in 1888 Engineering was made a four year course. At this time, W. R. Hoag, of the class of 1884, was made instructor. Professor Pike was made head of the College of Mechanic Arts in 1889. In 1890 all the freshman classes in the College were combined, the students not specializing till their second year. Up to the year 1890 just 29 students had received the degree of Bachelor of Civil Engineering.

On the resignation of Dean Pike, in 1892, the College of Mechanic Arts was reorganized, with Professor C. W. Hall as Dean. It was renamed the College of Engineering, Metallurgy and Mechanic Arts. In 1893 there were 27 students registered for Civil Engineering. F. H. Constant joined the faculty as Assistant Professor of Civil Engineering. Dean Hall resigned in 1897, and President Northrop acted as head of the College of Engineering until 1903, when Professor F. S. Jones was elected Dean. A new experimental laboratory was erected in 1898. This laboratory contained the most up-to-date equipment of the day.

The Civil Engineering Department grew steadily during this time, and in 1908 there were 137 men registered for this course. In 1912 the first of the new group of Engineering buildings, the main and experimental, were completed. These two buildings now house the entire department.

Alumni of the Civil Engineering Department of the University of Minnesota are pretty widely spread throughout the world. Word has been received from Sigurd Eliassen, of the class of 1918, that he is acting engineer in charge of the survey department of the Chihli River Commission, at Tientsing, China. Still another, J. L. Burt, class of '90, is a sugar planter at Jalisco, Mexico.

Many graduates are making successes in the line they originally started in; among these are some of the following: D. A. Allee, '02, is now civil engineering specialist with the General Electric Company, Schenectady, N. Y. N. W. Elsberg, '09, is city engineer for the city of Minneapolis. F. S. Douglas, class of '99, also, is city engineer for Covina, Cal. J. B. Gilman, '94, is chief engineer for the Minneapolis Steel and Machinery Company here in Minneapolis. E. A. Lee, '97, has the position of chief engineer for the Colorado department of the American Smelting and Refining Company. F. T. Paul, class of 1909, is superintendent of construction on the Cappelen Memorial bridge in Minneapolis. This bridge is rapidly nearing completion, and will be opened in a short time. W. P. Cottingham, '11, is city engineer for the city of Gary, Indiana.

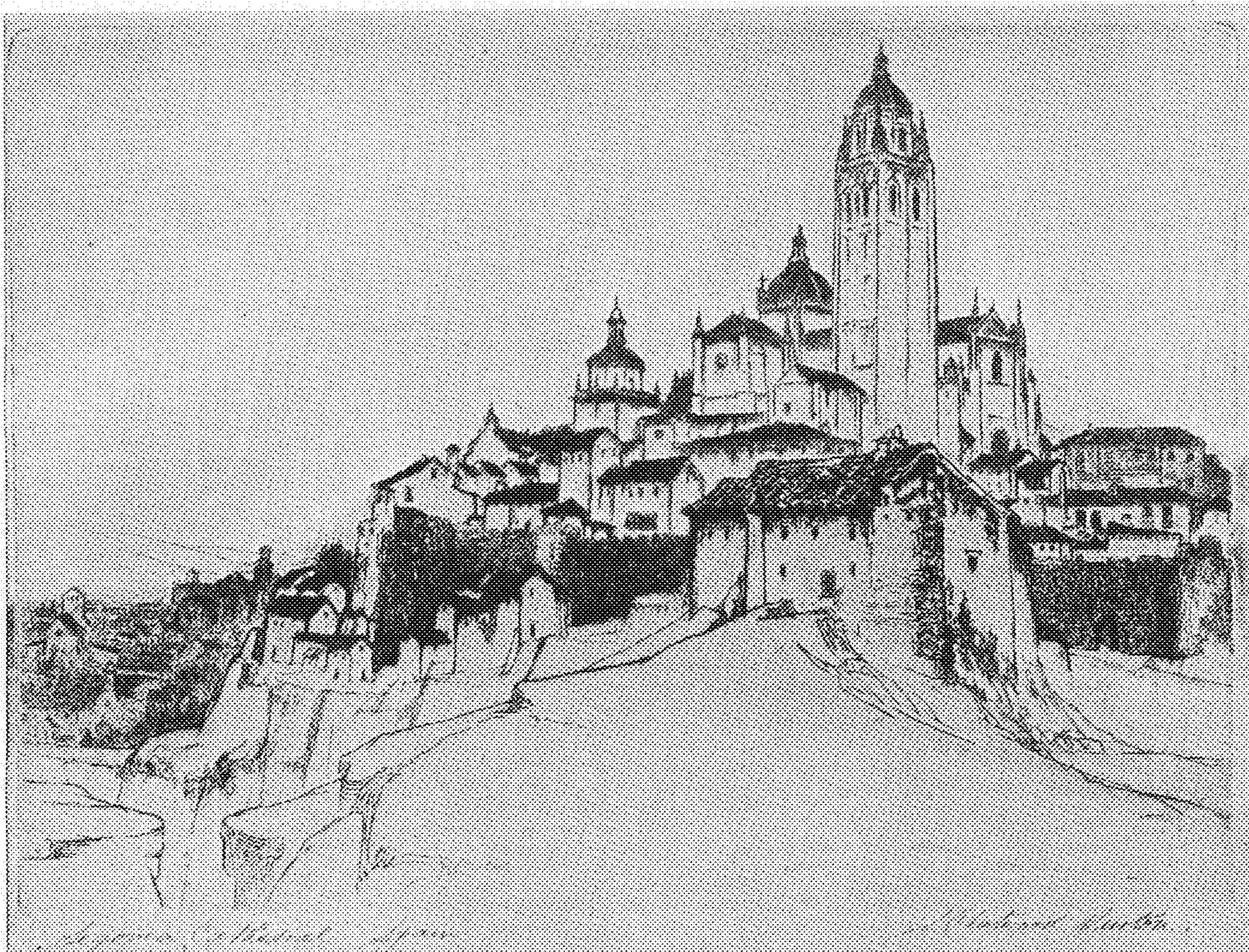
Several men have gone into various lines of railroad work. A. O. Cunningham, '94, is chief engineer for the Wabash Railway Company, St. Louis, Mo. H. B. Christianson, '15, is assistant engineer on the Chicago, Milwaukee & St. Paul railroad. J. A. Bohland, '95, is bridge engineer on the Great Northern. F. O. Fernald, '04, is superintendent of the Operating Department for the Pullman Company, Dallas, Texas.

The U. S. Government has several alumni on its payroll. Paul Rothi, graduate of 1904, is irrigation engineer in the U. S. Reclamation Service. R. W. Walker is a captain in the cavalry. L. A. Jones, '05, is senior drainage engineer for the Department of Agriculture. B. L. Chapman, class of 1910, is chief draftsman, U. S. Engineers, stationed at Rock Island, Ill.

A. S. Cutler, '05, and F. M. Mann, '92, are professors in Railroad Engineering and Architecture respectively, in the University of Minnesota.

Many men have left the field of Engineering entirely. J. C. Childs, '06, is sales manager for the

(Continued on page 32)



FAMOUS ETCHER AT MINNESOTA

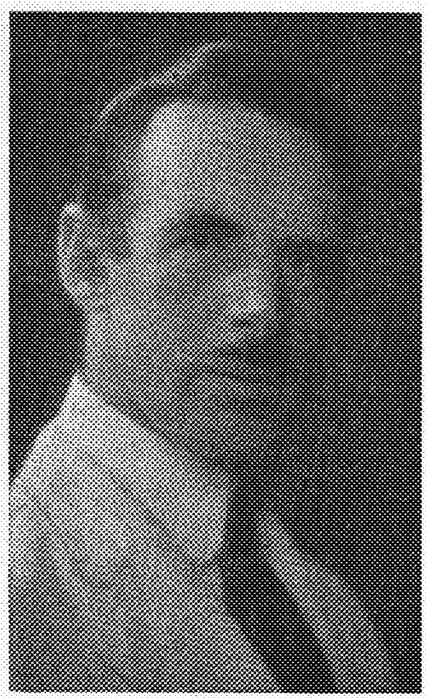
Professor S. C. Burton of the Architectural Department Is Highly Commended on Etchings of Spain

By Theodore Prichard, Arch. '25

TO THE lover and the artist it will be a great relief to know from a very reliable authority, that despite last year's onslaught by writers of popular music, there are still air castles in Spain.

An interview with S. Chatwood Burton, Professor of Architecture and dispenser of learning in the fine arts, reassures us on the subject. After listening two hours in rapt attention to his description of glorious Spain, even the hardest of hard-boiled engineers wondered how much the old Ford would bring, and the possibilities of working a passage on a cattle boat. Modesty and vocabulary prevents us from repeating what the co-eds said.

The land of romance, sunshine, warm days and charming architecture has been both over- and underrated, according to Mr. Burton, who spent last year in discovering Spain. It is only just that an American should discover Spain, seeing what Columbus did to our own country; and the simile can be carried even further, for while Columbus, a foreigner, set forth under the flag of Spain, Burton, an Americanized Englishman, set forth from American soil to display Spain and her grandeur; and Mr. Burton has really done this in many ways, as the visible results of his year's hard work show. In spite of uncertain means of travel and virtual inaccessibility of many of the little known villages in Spain, he remained undaunted and sought them out. Many of the villages in which he sketched had but few visitors a year, and some, as far as could be determined, had never been drawn or even photographed before. From bull fights to cliff dwellers, sunny gardens and barren plateau, he moved incessantly, living in the houses of the people themselves, and spending his days finding, and recording by means of the pencil, new objects and new vistas of incomparable charm and unparalleled interest. One of the many astonishing things, to us who have always heard Spain spoken of as a continuous garden of great fertility, is to hear that about two-thirds of the land is a barren waste, without sufficient water to sustain plant life. However, Mr. Burton assures us that the garden spots more than make up for this deficiency. The old saying, that he who has not seen Granada has not seen anything, is in a large measure true. The Alhambra, snowy mountains behind it, the gardens and life before it, and its charming self, make a sight that appease even the most exalted tastes. "And be sure," Mr. Burton said, "to see the interiors of the houses," for though the exteriors are wonderfully interesting, the actual life of the Spaniard takes place mostly within the courts of the houses themselves.



Professor S. Chatwood Burton

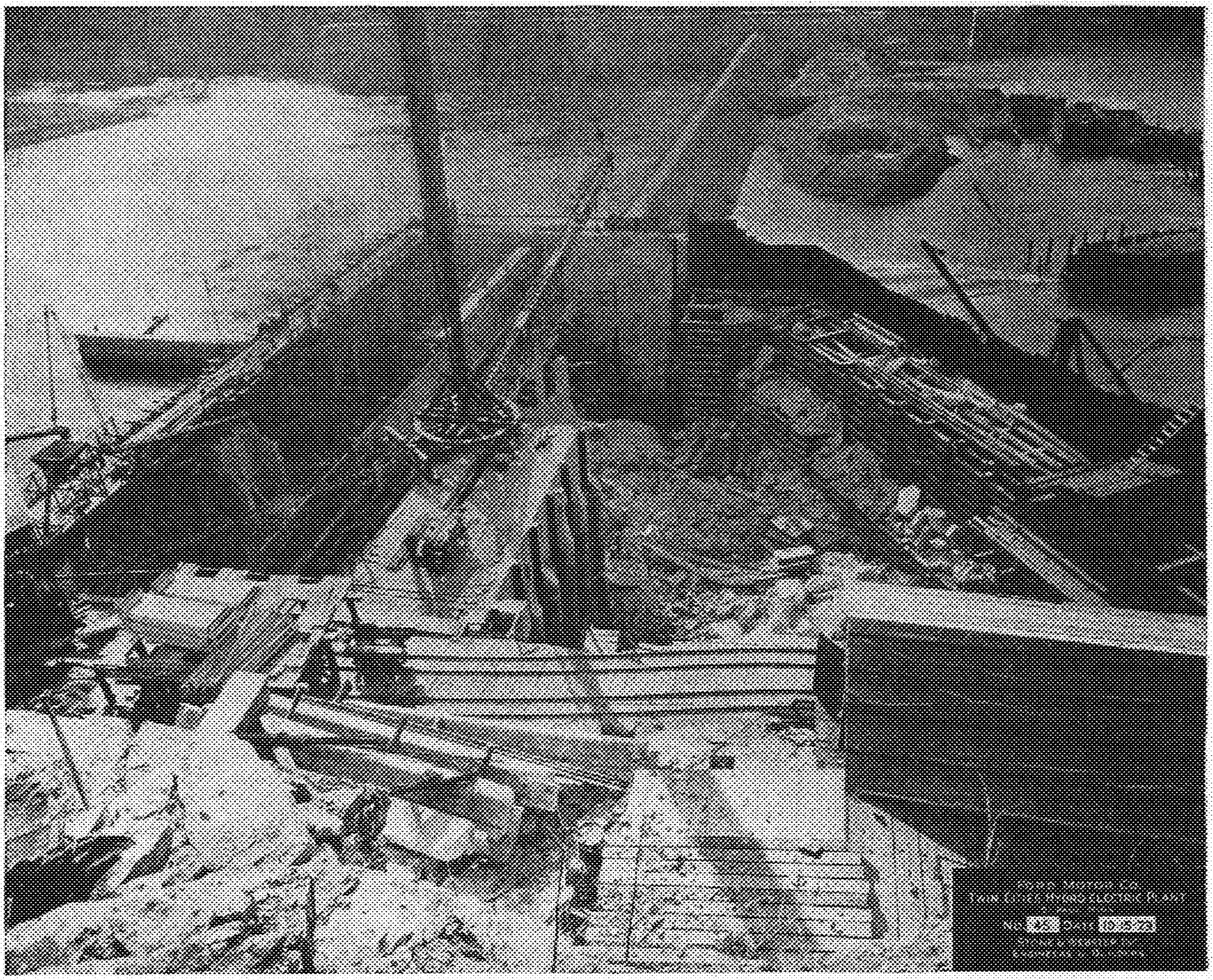
In this issue the Techno-Log is pleased to be able to reproduce two of Mr. Burton's most recent etchings. These two are taken from a group of exhibition etchings that Mr. Burton is making on Spain, and have won the admiration of critics all over the United States. This fall the Architectural League of New York are showing the entire group and at the present time they are being shown in many of the prominent galleries in the larger cities. The International Print Makers Exhibition in California also are showing this set, and last month the International Studio (high priestess among art magazines) reproduced four of Mr. Burton's original Spanish pencil sketches, with the following comment:

Spain Brilliantly Pictured in Pencil Sketches by an American etcher have the delicacy of dry points

Biographical sketches of S. Chatwood Burton ascribe to him seven different forms of activity in the furthering of art—painting, sculpture, etching, illustrating, writing, lecturing and teaching. It is with his drawing that International Studio is concerned at this time. For nine years he has been in charge of the studio art work at the University of Minnesota at Minneapolis. During the previous two years he taught art in the architectural department of the University of Illinois at Urbana. During this period he has won wide recognition in the Middle West, as well as numerous prizes, and his reputation has been extended by exhibitions of his etchings in New York, Washington and California as well as Chicago. Last year he traveled through Spain and Morocco and returned with more than three hundred works. He has toured also in France, Belgium, Switzerland and Italy. He was born near Manchester, England, and began the study of art in Blackburn. On a scholarship won in competition he spent three years in the art academies of Paris. "In them (the pictures published) is evident the fine feeling for line and mass that characterizes this artist's work."—International Studio.

The etchings in this issue are the Cathedral at Segovia and a view of Cuenca from across the gorge. The construction and locations of Spanish villages is such that it lends itself remarkably to the artist's pencil. Built mainly on the sides of steep and rocky chasms or piling themselves up in great irregular masses on the sheer sides of tall rocky formations, and usually surmounted by a

(Continued on page 28)



FORD GETS BUSY AT THE HIGH DAM

Design of New Exuipment Necessitated Change in Substructure
Latest Type machines being Installed

By R. E. Mathes, E. E. '24

AFTER nearly twenty years of struggle and argument, legal moves and counter moves, and submission of many expert opinions by as many different engineers, the controversy as to who should get the waterpower rights at the high dam built across the Mississippi River at the Old Soldiers Home by the Federal Government was finally decided late last spring. The power was awarded to the Ford Motor Company, of Detroit, for the purpose of supplying power to a manufacturing plant which that company proposed to erect very near the dam on the St. Paul side of the river. It was stipulated in the contract that any power not used by the Ford plant was to be sold to the Northern States Power Company so as at all times to insure the use of all the power developed.

When the Federal Government built the dam in 1913 it also built the substructure for a hydro-electric power house on the St. Paul side of the river. The intention was that whatever organization developed the power in the future could install the generators in a superstructure to be built over the base provided. This base, as constructed, allowed for four units of 2,500 kilowatts each.

A recent consideration of the problem developed the fact that it would be much more economical to rebuild the substructure for machines of the latest design rather than to try to use older machines that would work in the substructure as originally built. To this end it was decided to rebuild for three units of 4,500 kilovolt-amperes each. The construction plans were drawn up accordingly.

Actual work was started about the middle of June, 1923, and from then until the middle of October, the entire work was devoted to tearing out the old substructure. It was necessary to remove over three thousand tons of very strongly reinforced concrete. A small idea of the work involved may be gained from the view of the general operations. The walls of the turbine pits shown partially torn out extended across to a dam wall which ran from under the derrick to the wall at the end of the coffer dam which is parallel with the river. This was

(Continued on page 31)

SHOULD AN ENGINEER BE CULTURED?

Is it Necessary in Executing His Duty as a Citizen, as a Neighbor, or as the Head of a Family?

By H. M. Hill, B.S. '23

THE subject of this paper has been much discussed since the beginning of engineering education, and no entirely satisfactory conclusions have as yet been reached. It is, then, with a great deal of trepidation that I present my views of a matter that has puzzled men far more qualified to review the question. However, such observations as I have been able to make have caused me to form the opinion that there is a vast justification for the teaching of cultural subjects to engineers. In what manner or at what time these subjects shall be taught I am not going to attempt to say, beyond the point that I believe the importance of cultural subjects is great enough to warrant the requirement by Universities of a pre-engineering course, similar to those now offered to students entering the professions of law or medicine.

In general, what is meant by cultural subjects? Cultural studies, as I wish to discuss them, are those subjects which aid in the understanding of the ideals and aspirations of humanity, those that teach a man to become a better citizen and neighbor by giving a depth and breadth of view of what men have done and why—in short, cultural subjects are those whose aim is the enjoyment, appreciation, and understanding of the best and finest of the works and thoughts of man. I would include under cultural the whole range of literature, art, history, music, philosophy and science. Obviously it would be impossible for the engineer to more than skim the surface of all these subjects, yet it is quite possible for him to obtain some appreciation of their part in human affairs, and I do not believe a professional education is in any wise complete which does not give the opportunity to obtain the inspiration that cultural studies may give.

The value of any bit of knowledge to any man rests upon the use to which that knowledge can be put. Beyond a doubt, then, there are subjects which have for any individual, pecuniary value—he may earn his way in life by them; there are other subjects which have value to a man in executing his duty as a citizen, others a knowledge of which make social intercourse more pleasant, and still others whose value lies only in the personal satisfaction and enjoyment that knowledge gives. Hence the engineer must study primarily the subjects of his profession, the forces and moods of nature, for by them he lives, but he must have knowledge, also, to aid him in his study as a citizen, as a neighbor, and as the head of his own family.

The best engineer is he who thoroughly understands his own work, who efficiently and economically directs the forces of nature to a better service of mankind. Just so the best citizen employs his powers and knowledge for the good of his country and her people. The best neighbor is loved for his sympathy, understanding, and helpfulness, his service to his fellow men. The best husband and father is he who can wisely cherish and direct the lives in his care to the highest enjoyment and use of life.

Let us examine some of the deficiencies of the graduate engineer and see in what manner they may be corrected.

One of the most serious indictments of the engineering graduate is that, though he has a general idea of many things, he has a concrete, accurate knowledge of but a small part of the things he has studied. His ideas are hazy, his grasp of fundamentals weak. This is the complaint often made by employers, and it is interesting to note that the same criticism is made by the English of those Americans who elect to study in English universities. To what is this haziness, this apparent inability to follow a proposition to its ultimate statement, due?

Words are the basis of all knowledge, of all thought. By words we perpetuate knowledge and convey thought. Without words the most brilliant intellect is useless, we depend on words even to formulate thought within our own minds. An engineer should, and must be a clear, accurate thinker, for his problems must be solved to the last possibility, or serious damage and loss will be incurred. Engineering is a science, exact, allowing no deviation. Science is taught by words. Is it not, then, of paramount importance that the engineer have a thorough knowledge of words, their meanings, construction and uses; that is, a mastery of the English language? Cannot we attribute the haziness of ideas complained of by employers and others having connection with the graduate engineer to a fundamental lack of knowledge of his mother tongue?

A second weakness to which engineers are prone is the use of extremely poor English. In speaking this is often noticeable, and in writing the quality of English used by some technical graduates is so poor as to be embarrassing to the reader. Even the basic faults of spelling and punctuation appear in the written works of many engineers.

Engineering reports are often a source of annoyance to the non-technical reader, sometimes even to the technically trained man. This is not so often due to the use of wrong words as it is to the fact that the writer, having had but little training in writing, and, in all probability, less acquaintance with the methods used in writing, has neglected certain fundamental principles of conveying written information. The neglect of principles of arrangement, sequence, and punctuation, are the most common failings of written reports, making the meaning difficult to dig out. In some instances, the engineer, being so little accustomed to writing, omits important explanatory information altogether, forgetting that he is not talking face to face with a man who can easily ask for details not clearly stated. Important decisions have hung on the placing of a comma, or the interpretation of a badly written sentence, yet engineers very often consider punctuation and the logical arrangement of words of little consequence.

More and more today engineers are entering the executive positions of business and politics. In any position of leadership it is necessary to have a thorough command of English. There must be no confusion in the mind of a subordinate when he is told to act. Policies must be clearly expressed, or public support is lost. Competition is too keen in this world to allow a man more than the necessary time to state his views. If one man does not make a clear statement his competitor will, and the race is to him who is first understood.

Here, then, are tangible uses in engineering for a cultural subject, that of the study of the English language. A study of grammar alone is neither interesting nor desirable, but a study of the meaning and use of words is fundamental to any education. The accurate expression of thought, written or oral, the conveyance of information, these are the ends to be sought.

There is some doubt as to the value of the study of languages to members of the engineering profession, except in individual cases where a man's work or study is to lie in foreign countries. It has been contended that the study of French and German are an essential part of a technical education, since those two languages contain a large part of the present day scientific knowledge. However, since it requires a large amount of time, and considerable effort, to obtain even a working knowledge of a foreign language, it is extremely doubtful whether the returns gained from the knowledge are commensurate with the time and effort expended. There is a good reason for this doubt in view of the many excellent translations obtainable of foreign works on engineering and science. Current discoveries, inventions, and methods are rapidly translated and published in English technical journals. These also separate out the unusual, or at least that material which is applicable to the engineering of this country, for publication, thus saving a deal of searching in an unfamiliar language for useful material in American engineering problems. Scientific works, being, in the main, straightforward accounts or explanations, do not lose in translation as does the literature of other subjects.

There is a value in the knowledge of languages where the student has time for their study. In many ways a foreign language helps to a better understanding of English, or rather to a better expression of thoughts in English. There is a large amount of training in the value and use of words in the study of languages, since the student, not being as familiar with the language he is studying as he is with English, will not take the liberties with it that he will with his native tongue.

For the engineer engaged in research there is a real value in the knowledge of French and German. Experiments and articles of little or no value to the practicing engineer may be of extreme importance to the research man. These articles would but rarely be translated, hence the value in being able to read such articles in the original.

History, as a study, does not often appeal to engineers—this is chiefly because engineering as a profession has as yet but little written history. However, the history of the world has been so profoundly affected by the things engineers have builded, that, if nothing more than professional pride impels, a study of history is well repaid by the discovery of what engineers have accomplished in the past, and the augury of the future that may be read in what has already been accomplished. Power, the factory system, communication, transportation, these are engineering achievements that have quickened the world, and profoundly modified events. We are at present in the midst of a very flurry of scientific and engineering work whose end no one now foresees, but which will undoubtedly be written in future histories.

Engineering is undergoing rapid changes, and engineers in their professional capacity are undertaking enterprises which hitherto would hardly have been considered orthodox engineering. Problems of conservation, the relation of capital and labor, public works, city management, these are some of the problems confronting the new engineer, and while they are problems peculiar to this age, they can profitably be studied in the light of history, especially as they demand that the engineer enter a field in which he is practically unknown, that of politics and government. Here are problems that the past can illuminate, for here the engineer is dealing with people in the mass and the relations of humanity. People have been reacting to the same stimuli since history began, and will continue to react in the same manner to the end of time. New laws must be worked out and put into effect. What will be the probable result? Gigantic movements are taking place in the world of labor. These movements must be analyzed by the engineer in order that the civilization he has builded may not be destroyed. These are new problems, yet history can throw light on them. History will be a profitable study for the new engineer.

In what way can the engineer profit from a study of the arts, of literature, and of music? It is true that there is practically no engineering value in these subjects, but the engineer has other obligations than those of his profession. There is his obligation to his fellow men of being a good neighbor and companion. The engineer is notorious for his inability to talk anything but "shop," even during the time he is in college, when his interests are, perhaps, more varied than at any subsequent period of his life. This lack of breadth of view and of general knowledge has resulted in a clannishness not good for the profession. The professions of law, medicine, and the ministry are given an honored place among the activities of man because they have intimate contact with the daily life of men. The engineer's profession is more or less obscure and hazy in men's minds because that profession deals largely with inanimate objects. The works of the profession, but not its workers, touch men's daily life. A knowledge and appreciation of what is fine and good in the work and thoughts of others is the surest way of having one's own work recognized. In this lies the value of the study of certain of the cultural subjects.

As the activities of the engineer become more and more diversified, as he enters the field of business and world affairs, there comes a pressing need for education in the fundamentals of economics, accounting, finance, and law, especially business law, as these subjects relate directly to engineering activities. This need is being recognized by colleges, and courses designed for the engineer are

(Continued on page 29)

SPORTS

ENGINEERING ATHLETICS

This fall the engineers have again shown themselves victors in Intramural Athletics. The various shields and trophies which decorate our library point to similar victories in the past, and the spirit has not died. It is very creditable. Intramural athletics, because they take in everyone, strike at the heart of the purposes of the Physical Education Department and are certainly well worth all the support we can give them.

Thus far a tennis and a golf tournament have been played, and engineers have been victorious in both.

Arndt Duvall, junior civil, recently won the University tennis championship by defeating Irving Ruben in a hotly contested match which ran four sets before a decision was reached. Duvall has been playing an exceptional brand of tennis and well deserves the victory.

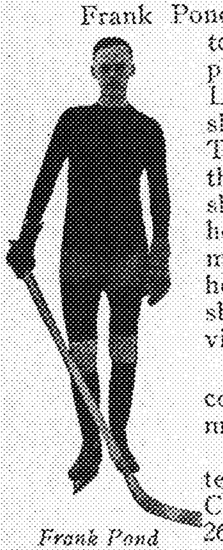
The first set started out in quick fashion with Ruben in the lead. Duvall failed to get his bearings in time to turn back his opponent and lost the set 6 to 4. After this initial round both players settled down to a steady pace in which Ruben was gradually left behind, losing the next two sets 6-1 and 6-1.

The fourth set was closer than any of the others. Ruben seemed to have freshened up and made the champion miss several difficult shots. This comeback was soon stopped by Duvall, who won the set, 7-5, thus giving him an undisputed right to the championship.

The rain of the previous night, which made the courts quite heavy, accounts for the slow playing by both of the men. Ruben trusted mostly to his placing of shots while Duvall showed a variety of strokes, including a beautiful backhand return.

Capt. Arthur Jacobsen

Frank Pond, Senior Mechanical, won the golf tournament by defeating F. M. Murphy, School of Mines, at Columbia Links. It was a close contest, Pond shooting a 74 against Murphy's 75. The men were on equal footing on their driving and putting. Pond showed superiority in his iron shots, however. Murphy's opportunity of making the score 1 up came at 17th hole, where unluckily he missed a short putt, giving Pond the chance for victory.



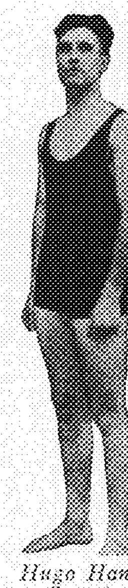
Frank Pond

These two championships cover the contests under the intramural department thus far completed.

Football was begun, most of the interest being centered around the Chemist-Miner game, which ended 26-0.

Soon basketball and hockey season will be under way. Basketball has already been started by class managers and should develop successfully. As before there will be undoubtedly class eliminations and the picking of an all engineering team. With the support of the chemists, who will also be represented on this team, we will be materially aided and things point to a successful season.

The Athletic Department issued a statement that a skating rink will be established just north of Washington Avenue on the Engineering group lawn. The rink will be for engineers only and thus overcrowded conditions will be eliminated. This means that there can be inter-class contests in this sport as well as the inter-college games which were formerly played.



Hugo Hauft Captain

Two Engineer Captains

Arthur Jacobson, Junior Electrical, has been piloting the cross-country team of this year and has been one of the most consistent winners. The Grinnell College team was taken into camp by our harriers, who lost, however, by small margins to Wisconsin and Iowa.

Hugo Hauft, Junior Electrical, has been chosen to lead the Gopher tank squad. Hugo is a back-stroke and dash man.

Engineers Won in '16

Chas. W. Stone, mechanical engineering '17, is now selling machine shop equipment for Niles, Bement, Pond Company of St. Paul. Mr. Stone played fullback and called signals on the engineers' championship football team of '16; the team did not allow an opponent to cross their goal line during the entire season. Chas. announces a daughter, Elizabeth Ann, now seven months old. His home address is 3432 Chicago Avenue, Minneapolis, and his business address, 334 St. Peter Street, St. Paul, Minnesota.

T. S. Paulson, civil engineering 1922, since graduation has been with the Foley Brothers, building and railroad contractors. He has been on instrument work on construction, inspector, and assistant resident engineer on the building of Nazareth Hall on the shores of Lake Johanna. His address is 1595 Blair Street, St. Paul, Minnesota.

Thomas A. Askew, Jr., civil engineering '16, was married to Jeannette Hibbert at Maryville, Tenn., on August 23. Mrs. Askew is a graduate of Maryville College, class of 1921.

ALUMNI NEWS

In the hope that we can locate a number of "lost" engineers, we will publish a list of names in each issue of the Techno-Log. These are names of men who have changed their mail address and of whom we have no location record. The Techno-Log and the dean's office are desirous of keeping a complete and up-to-date record of our alumni. If you have any knowledge concerning these men you are urged to send it to the alumni editor of the Techno-Log.

Architects:
- Mr. Lawrence H. Bakken
- Mr. Edgar Buenger
- Mr. Linton H. Kreinkamp
- Mr. Jacob J. Liebenberg
- Mr. Delos C. Washburn

Civils:
- Mr. Christopher Aasland
- Mr. Harvey B. Anderson
- Mr. Walter E. Beneka
- Mr. John E. Bergquist
- Mr. William J. Bingen
- Mr. Nathan H. Bouge
- Mr. Byron H. Bradey
- Mr. John W. Comstock
- Mr. George Cottingham
- Mr. William P. Cottingham
- Mr. Thomas H. Curtis
- Mr. Philip L. Dahlquist
- Mr. John A. Dunham
- Mr. Carl Ekberg
- Mr. Max Feder
- Mr. Joseph E. Finley
- Mr. Roy Gilbert
- Mr. James A. Grant
- Mr. Williston W. Greenwood
- Mr. Roberts Grow
- Mr. Christian Hallan
- Mr. Harry G. Hawley
- Mr. C. E. Handschu
- Mr. Fred A. Hubbard
- Mr. Simon Ingberg

SVERDRUP ON MISSOURI HIGHWAYS

L. I. Sverdrup, civil engineering '21, is in the employ of the Missouri State Highway commission, where he has been since October, 1922. He is employed as engineer in charge of the Missouri and Gasconade river bridges. Previous to this time he was employed as bridge designer for the Minnesota State Highway Commission. In his present position he has charge of four bridges over the Missouri River and two over the Gasconade River. The total cost of the six bridges will be about $4,800,000. The caissons for these bridges were sunk under air pressure. While in school Mr. Sverdrup was on the swimming team, captain of the Ski team, a member of the Cosmopolitan Club, and a member of the Gopher staff. Address mail to box 372, Waverly, Missouri.

Alice Little, architecture '22, who has the distinction of being the first girl to receive a degree in architecture at Minnesota, is now teaching in the Chisago Lake High School. The high school is situated half way between Center City and Lindstrom, the latter place is where Alice gets her mail. General information is, if you want to dance, play cards and go to movies you stay in Lindstrom; if you want to go to church it is Center City. We are backing Alice in her judgment of a residence.

Henry M. Lende, civil engineering '20, writes to us requesting that we send his Techno-Log to his new address, 51 South 13th Street. He says, "I am in the employ of the Minneapolis Park Board doing accounting work and find the surroundings, former grads and everything, very congenial." In writing us this bit of news, Henry has set an example we wish more alumni would follow.

T. G. Gerow, mechanical engineering '20, is engineer for the Republic Coal Company of Minneapolis. This company has mines at Minot, North Dakota; Zap, North Dakota, and Herrin, Illinois. Mr. Gerow is engaged largely on mine production. He announces a son, William Gardner, fourteen months old. Mr. Gerow can be reached at his business address, 620 Palace Building.

J. A. Forsman, who has been chief engineer of the refrigerator plant of Swift and Company, at South St. Paul, has resigned and will leave for South America. He will take charge of a plant at Montevideo, Uruguay, owned by Swift and Company. Mr. Forsman resigned as president of the St. Paul Branch of refrigerator engineers.

W. P. Tarbell, civil engineering '22, was a recent visitor of Prof. Zelener at the University. He returned to Fargo, North Dakota, Tuesday, November 13. Mr. Tarbell was with the North Dakota State College during the year 1922-23 teaching engineering subjects. He is now with the city of Fargo in charge of sewers, waste supply, and surveys. On June 30th, Mr. Tarbell was married to Miss Olivia Eldebrock, head of the piano department of North Dakota Agricultural College at Fargo. We expect to hear more from him in his new capacity.

From the U. S. Coast and Geodetic Survey Bulletin dated October 31, 1923, we extract the following interesting news concerning our alumni:

Under the date of September 14, 1923, E. H. Pagenhart ('05) director of coast surveys, Manila, P. I., reports the following field work in progress during the month of August. The *"Pathfinder,"* F. G. Engle commanding, continued on surveying duties in the vicinity of Sarangani Bay throughout the month.

The *"Fathomer,"* H. A. Cotton commanding, remained at Engineer Island undergoing annual repairs throughout the month.

The *"Marinduque,"* C. A. Enger commanding, continued on surveying duties in the Sulu Archipelago throughout the month.

October 23, 1923, Hibbert M. Hill ('23) to report in division of Geodesy. "Hib" was visiting at the "U" last month.

Burt Henry, civil engineering '21, is working for the Gauger-Korsmo Construction Company of St. Paul.

F. H. Klemer is still living in Faribault, Minn., where he built himself a new home last year. His oldest child, a daughter, is now a junior in high school, a son is in the eighth grade and another daughter is in the fourth grade.

L. M. Bergford, civil engineering '23, is field engineer for the Portland Cement Association, Metropolitan Bank Building, Minneapolis, Minn. This association is a national organization with an aim to improve and extend the uses of concrete. Mr. Bergford writes us that in his capacity of field engineer he is highly enthusiastic over the work being done. While in school "Les" served on the Techno-Log as alumni editor, associate editor, and finally as editor.

Fred W. Buck, engineering '09, is still in the real estate business in Duluth. He has been with Stryker, Manley and Buck since 1912.

Earl L. Neville, civil engineering 1920, is another grad with the Foley Construction Company of St. Paul. He is employed as engineer on the St. Paul Union Depot. His home address is given as 3223 Upton Ave. North, Minneapolis, Minnesota.

Norman Hendrickson, civil engineering 1916, entered the service of the Kalman Steel Company, Builders Exchange Building, on Feb. 1, 1923. He is employed as estimating engineer. From his home, at 4715 16th Avenue South, we have the news of a baby girl, Ruth Carolyn, born May 17, 1923.

Chas. (Chuck) Doell, civil engineering 1916, is assistant secretary for the Minneapolis Park Board. He announces the arrival of a new baby girl.

Ralph Johnson, civil engineering 1916, is with the Kalman Steel Company in charge of their office in Detroit, Michigan.

I. L. Boyum, electrical engineering '17, is employed in Municipal Power Plant at Watertown, South Dakota, where he is assistant superintendent of the plant and superintendent of electrical distribution. Previous to May, 1922, when he assumed his present duties, Mr. Boyum was employed by the Commonwealth Electric Company of St. Paul, in whose employ he acted as supervising engineer on power plants, transmission systems, and industrial power systems. On April 3, 1918, Mr. Boyum and Gladys P. Hill were married in Minneapolis. They have two children, Burton, aged two, and Billy, aged four. While in school Mr. Boyum was a member of the Engineering society, A. I. E. E. and treasurer of the senior engineering class of 1917.

Rockwood C. Nelson, civil engineering, is appraisal engineer with the Realty Trust Company, Penobscot Building, Detroit, Mich. The firm specializes in real estate securities in Detroit, such as land contracts, mortgage loans, real estate gold bonds, and general trust business. Ethel Harwood Nelson ('16), his wife, is accompanist for the Detroit Tuesday Musicale club and chairman of the music committee of the Detroit Pi Beta Phi alumnae club. They are living at 2090 Pingree Avenue, Detroit, Mich., where Minnesota friends are always welcome.

IRISH BANQUET PROMOTER RETURNS

Ed Leach, civil engineering '10, and his wife were visiting Minneapolis and the university during homecoming. They were spectators at the Iowa-Minnesota football game, and at the alumni banquet Friday evening, Nov. 16th, in the Minnesota Union. Ed is general superintendent of the western district for the Pickands Mather Company, mining operators. When the campus improvement work and the heating tunnel were started Mr. Leach was assistant to Professor Zelener on this work. By the way, we wonder if Ed is managing any more banquets for the Irishmen.

F. W. Hoorn is a captain in the Signal Corps of the U. S. army, having charge of the signal corps unit at the University of Michigan, Ann Arbor.

RADIO ENGINEERING COMPANY FORMED

As a sequel to the story of the invention of a new radio device comes the news that David S. Grimes has sold important patent rights to the Bristol Company, Waterbury, Conn., for the manufacture and sale of the Grimes Inverse Duplex radio receiving set, and that his royalties are expected to reach the half million dollar mark in the next few years. Mr. Grimes has also formed his own company, the Grimes Radio Engineering Company, which still retains certain patent rights to the device. He will go to England in January to dispose of the patent there. The fundamental idea on which the Inverse Duplex system is based is said to have been conceived by Grimes in 1917, when he was a lieutenant in the Army Air service, and was given the task of perfecting a more sensitive method of intercepting radio instructions sent to German aircraft sent out on bombing missions. According to radio experts, Mr. Grimes' inventions are concerned principally with radio frequency amplification, by which signals too weak to operate a detector can be increased to a point where detection is possible. Mrs. Grimes was Cecil Hoag. They are living on Staten Island, N. Y.

J. E. Sorensen, D. C. Wills, '23, J. B. Wiggins, '23, A. C. Ward, '23, W. F. Helwig, '22, E. W. Clausen, '23, E. H. Eige and E. Lindelien are all with the Western Electric Company at Chicago.

Donald Marshall, Jr., arrived at the home of Mr. and Mrs. Donald Marshall of Staten Island, N. Y., on October 8th. Mrs. Marshall was Dorothy Ford, daughter of Robert E. Ford, of Minneapolis.

Richard T. Daly is sales manager for the Kalman Steel Company, St. Paul.

Carlos del Plaine, B.S. '20, C.E. '21, is with Wm. Murphy & Son, general contractors, St. Paul. His new home address is 6 Barton Avenue S. E., Minneapolis. Mr. del Plaine acts in the capacity of general engineer.

Harry Brown, M. E. '22, is employed by the Fairbanks-Morse Company in St. Paul.

Donald Graf, Arch. '22, who was formerly associated with Silas Jacobson, architect, in St. Paul, has now moved to Minneapolis and is working for Alexander Rose, architect.

Archie J. Dowd, electrical engineering, is with the Western Electric Company at Cicero, Ill., where by hard work and close attention to business he has won rapid promotion to department chief. Friends of Archie's in Cicero say that he is one of the youngest men ever to occupy such a position, and we understand, also on good authority, that his achievements are not without their material reward. He is living in a suburb of Chicago but returns to Minneapolis occasionally to visit his parents.

Ted Kopper, mechanical engineering '14, is with the H. C. McNair Company. He is selling tool steel and railway supplies. His mail will reach him at 343 Endicott Building, St. Paul, Minnesota.

We have located three men of the '22 civil engineering class who are now located at Two Harbors for the Minnesota State Highway Department. C. A. Thompson is handling an instrument, Dewey Mattson is in the office and Vic. R. Wood is resident engineer.

F. W. Hvoslef, mechanical engineering '17, and graduate '19, is still assistant chief engineer of the United States Radiator Corporation.

A. W. Schoepf, electrical engineering '08, is electrical superintendent for the Monongahela Power Company at Fairmont, West Virginia.

M. J. Orbeck, electrical engineering '11, has secured a year's leave of absence from the University of Michigan. He is at present resident engineer for the Eastern Iowa Power Company, and is on construction of the power house and dam near Maquoketa, Iowa.

L. J. Dunlap, electrical engineering '17, is with the central section division of the Westinghouse Electric Company. He is located at Madison, Wisconsin. No doubt he had trouble with his voice after cheering Minnesota in their annual contest with Wisconsin.

B. W. Gaarud, electrical engineering '21, is working for the United States Bureau of Mines in their station at the University of Alabama.

Chuck Burrill, electrical engineering '23, is located in the radio testing laboratories of the General Electric Company at Schenectady, New York.

Quite a few electrical engineering gradlates do not discontinue their studies when they leave Minnesota. Almost every month we get a notice from the News Bureau of the General Electric Company at Schenectady, New York, telling us about Minnesota alumni. This time we hear that L. T. Bumgardner, E. W. Engstrom, R. N. Williams of the class of '23 and B. C. Maine '21, are engaged in the students' training course of this company.

R. E. Ost, civil engineering 1922, is holding a position with the Northwest Paper Company at Cloquet, Minnesota. He is assistant resident engineer on paper mill construction. Address mail to 202 14th Street, Cloquet, Minnesota.

Do you remember Lawrence (Larry) Teberg? Sure you do, everyone does. He is another member of the civil engineering class of 1922. The Great Northern railroad has him in their bridge department.

Mr. LeRoy L. Wyman, Chemical Engineering 1922-23, is teaching Metallography in Oklahoma School of Mines, Wilberton, Oklahoma. A baby girl, Gertrude Leona Wyman, arrived on Labor day. Mr. Wyman married Miss Frieda Haupert of the class of 1922. While in school Mr. Wyman was drum major in the University band.

Of the June graduates Dick Hennessey is with the architectural department of Minneapolis school board, Elving Johnson is working in Huntington, West Virginia, and Richard Magee is teaching at the North Dakota State Normal School. Quite a distribution, but characteristic of our alumni.

Olaf Oustad, civil engineering 1915, is a building contractor in Burbank, California. He is specializing in that famous type of home known as "the California Bungalow."

Among the Techno-Log mail we find a letter from Lyle A. Dills, civil engineering 1921. Much to our joy he has offered his services in locating alumni of the class of '21. His invitation to visit him in his office, room 208, Experimental Engineering building of this college, is not going to be passed up. He gives a change of mail address to 722 McKnight Building, Minneapolis.

We have a letter from E. C. Manderfeld, electrical engineering '21, located with Engineering Department of the Western Electric Company, 463 West Street, New York City. He expresses his desire to give any information he possesses to men who intend going east after graduation. That is the old Minnesota spirit. We are looking forward to a news article from Mr. Manderfeld and hope it will arrive in the near future.

We are always glad to furnish information to our alumni. Recently we received a letter from Fred Benedict, electrical engineering '03, 949 Burwell Avenue, Bremerton, Washington. He is desirous of subscribing to the stadium fund and requests information concerning the procedure. It is twenty years since Mr. Benedict graduated but his Minnesota spirit is still apparent. Fred is with the Navy Dept.

Captain Henning Linden is at present instructing military science at the University of Maryland, College Park, Maryland.

We are always anxious to hear from the older grads. For this reason we were pleased to get a subscription for the Techno-Log from J. E. O'Brien, mechanical engineering '98. Mr. O'Brien is chief of motive power and equipment for the Seaboard Air Line Railway Company at Norfolk, Va.

N. S. Anderson and C. L. Sivanson of the '22 civil engineering class are located with the Shuett-Meier Company, Structural Engineers, 718 Washington Avenue North. They are engaged on reinforced concrete and structural steel work.

L. L. ("Les") Halladay, civil engineering '21, took employment with the Minneapolis City Planning Commission in August, 1922. He was transferred to the engineer's office of the Board of Park Commissioners in May, 1923. He is now engaged on the construction of the Nokomis-Rice Lake bridge, the new bridge near Minnehaha Park and on the retaining wall along the Calhoun boulevard at the Minikahda Club property. His home address is 5526 Pillsbury Avenue.

L. M. Mitchell, civil engineering 1915, during October visited the university on business. He is located with Naufits and Bergstrom, building contractors, Duluth, Minnesota.

Our old friend, George Schaller of the 1923 civil engineering class, was with us at the Northwestern game on Nov. 3rd. George was with the Northern Pacific railroad at Duluth from the time he graduated until Sept. 18. Since that time he has been field draftsman for the State Highway Department. He has been located at Mankato, Waseca and Blue Earth. Address his mail to 3347 Aldrich Avenue South, Minneapolis, Minnesota.

Among the visitors this fall we find C. E. Hemsey of the 1922 class of mechanical engineers. He is with the Carolina Power and Light Company located at Raleigh, North Carolina.

EDITORIALS

WELCOME MINERS

We are glad to welcome the students of the School of Mines into their new field of endeavor—that of editing.

There has long been a feeling among the miners that they wanted something in the line of a publication that they could call their own and in which they could record some of the interesting happenings of each year. The publishers of the Techno-Log have also felt that these men should be allowed to share in its privileges as well as the students in the School of Chemistry and in the departments of the College of Engineering and Architecture. With the dissolving of the A. E. S. and the establishing of the Minnesota Techno-Log as an entirely independent student enterprise all objections and obstacles in the way of combining our efforts were eliminated, with the result as noted on the cover, "Published monthly, etc."

We have always felt that there was a kindred feeling between the men in the various branches of the technical field and that we should become better acquainted with them while we are still in college. After conferring with Dean Appleby and the class presidents of the School of Mines we realize we have missed a broadening influence in not having been associated with them before. When we are out in our field we will undoubtedly be continually meeting the men from the other departments, due to the close relation existing in the work of each, and it will be an added help to have already established an understanding and a feeling of co-operation.

Again we welcome you, students of the School of Mines, and we thank you for taking hold of the work in such a fine manner.

ON WRITING REPORTS

"This report will be due next Monday," so the instructor informs us and we silently make a note in our leather bound books. In our next class we get the same thing and so on down the line. There is no distinction made regarding the type of report, it is merely the same stereotyped report that we have been making ever since we began to write them in our sophomore year. First comes the Title, then the Object, Discussion and Theory, Apparatus, Procedure, and finally the Conclusion. Note: All curves and drawings must be in India ink.

True, the training which we get by writing these reports helps us to get many details which we as students might otherwise miss and it gives us a standard by which to write everything, but is this to be desired? In the field when we are asked for a report a certain definite item is usually the only part of the entire work which is of interest to our superior. Conclusions and the data upon which they are based are the only items of interest. Time is also a factor which must be considered. Very few busy men care to waste valuable time wading through a long detailed report with a couple of pages of theoretical discussion. What these men desire is the results with the conclusions in a condensed form so that they can understand them.

For example a city engineer wanted a report on a certain type of pump that was being considered for the city waterworks. Specifications were that the conclusions and arguments should not take longer than three minutes to read and that the terms used should be familiar to the city council. This happens to have been the task of one particular consulting engineer but specifications of this nature are not uncommon among our graduates who are in the field.

A problem of this nature would be difficult for any of our men to perform readily, due to the nature of the reports they are accustomed to writing. We believe that far better experience could be gained during the junior and senior years if reports, filling actual practical conditions, were substituted for the present stereotyped form.

A GENIUS IS GONE

Within the last month the scientific world has been dealt a very severe blow in the death of that great genius, Steinmetz. There are few men who have ever contributed to their field such a wealth of material from both the theoretical and the practical side as has this peerless electrical genius. It has been said of him: "He was allowed to try to generate electricity out of the square root of minus one." This, to many students, is probably quite as conceivable as are some of the long and "obvious" mathematical proofs which were so simple to him.

Steinmetz was indeed like few other men as Professor Karapetoff of Cornell clearly shows. "It was impossible," he writes, "to make him do anything except what he himself desired to do. He stayed away from the works for days; he smoked in buildings in which the president himself did not dare to smoke; he used the clockwise rotation of vectors when everybody was using the opposite rotation; he insisted on saying 'ze' for 'the'; he wore a soft shirt and a shabby gray suit at formal functions, and he belonged to a political party that cussed his company and its principal customers for years."

We are glad that such a genius, who under adverse conditions might easily have been a failure, was associated with a great company that knew how to treat a man of his ability.

Reinforced concrete barges originally built by the United States Government for use in New York harbor during wartime are now serving as bases for river warehouses at Cairo, Ill., for traffic on the Ohio and Mississippi rivers. These barges, 226 feet long by 36 feet wide, were anchored side by side, and on them a warehouse, 200 feet long and 56 feet wide, was constructed. Cranes give service to a car float on one side of the warehouse and river barges and boats on the other.

COLLEGE NEWS

NOVEMBER DESIGN AWARDS

Freshman Design:

A PORTFOLIO COVER

High Awards:
W. A. Close
A. Frazin
Martha E. Sampson
Eleanor Brooke
Herbert Jennings
A. J. Brenner
Roy N. Thorshov

Sophomore Short:

A SUN DIAL

Mentions:
Gerald Kronick
A. G. Lumm
Rhoda Coté
Helen Parker
Verna Smith
Samuel J. Sutherland
Wm. J. Witherspoon

Sophomore Esquisse—Esquisse:

A FIREPLACE

Credits:
Rhoda Coté
D. Doon
Claude Flegel
Dewey Gerlach
J. T. Grisdale
Clyde Lighter
Mary Slocumb
Samuel J. Sutherland

Junior Short:

A MOTOR-BUS TERMINAL

Credits:
P. P. Bross
E. W. Krafft
William Woollett
Herman Frenzel
Everett Peterson
W. A. Kendall
George Freeberg

Junior Esquisse—Esquisse:

A CIVIC CENTER

Credits:
George Freeberg
Dorothy Brink
William Woollett

Interior Decoration 1st:

A SALON IN THE GREEK REVIVAL

Mentions:
Alberta Eberhart
Gladys Hernlund

Interior Decoration Esquisse—Esquisse:

A DANCE-HALL ENTRANCE

Mention Commended:
Carl Matthias Wise

A SCHOOL FOR STUDENTS FROM OUR COLONIES

Mentions Held:
C. H. Hinman
T. Woodner Silverman

Mentions:
Wallace Bonsall
C. R. Barnum

CARLYLE SCOTT'S MUSICAL ARCHITECTS

Lecture Number Two

Goethe in one of his less inspired moments announced that architecture is frozen music; and tourists before the Milan cathedral have ever since delighted in repeating this remark, hoping to gain thereby a reputation for aptness, if not for original wit.

But if Goethe called architecture frozen music and still died an honored man, we may intrepidly explain the presence in the department of a vast quantity of oft-times recognizable music by calling it melted architecture. Mr. Arnal, who is often pained at the paucity of architecture to be discovered on criticism days (and the other design professors likewise) may be relieved, if not much comforted, to learn that the architecture is absent simply because it has melted away into the *Marche Militaire*, or a passage from the *Unfinished Symphony* or other flowing melodies of Schubert revived since *Blossom Time*.

Yes, Goethe was right, after all. There is an affinity between architecture and music. Mr. Lindsay, professor of piano in the Music School, has been known to visit our library hungry for the sight of cathedrals and Mansions of the Olden Time; and it is a pleasant exercise on symphony nights to pick out from the second balcony the various architectural faculty crania (meaning heads) as they shine with greater or less luster from out various parts of the audience.

Here squeaks Miss Harwood's chair in as melodious a voice as the sat-on ever muster; here is Glanville whistling the latest Schoenberg-Ornste in quarter-tones to an enraptured audience, sounding methinks, much like the aforementioned chair; here goes Izzy, while the *Sixth Raphsody* of Liszt curls behind him in brassy clangor; here labors persevering Bill, who chants antique folk-songs of how "The animals came in two by two, one wide river to cross;" here Dorothy Brink initiates the innocent into the mysteries of *Father Noah;* while Magoon gives competition in his theme and variations from *On Wisconsin*. Here, too, when the shades of night have been drawn down, is organized a tympany orchestra, made up of dinned paint-pans, rattled knuckles, struck drawing-boards, and a medley of cock-crows, cat-calls and five o'clock whistles. This music, through its acting as outlet for the eternal human ρυθμος of which Mr. Havelock Ellis so lengthily writes, is conceded to be very soothing to nerves too long repressed in the doing of the endless similar small tasks of draftsmanship.

Here, too, exists informal after-dinner opera of a nature so powerful as to drag the after-dinner librarian from his seat of duty two floors below to inquire, in accents suggestive of those of an elder brother abashed by the public naughtiness of a younger: "Do you *have* to do that?"

Ah me! music, it is a melting thing. But some there are who pray for the speedy arrival of freezing weather. Perhaps they prefer skating to swimming, or mosaics to musicales.

Non-Art News

To supplant in part the murals washed from the Senior drafting-room walls during the summer rains, a new décor has made its appearance. In nature it is allegorical, for in the midst sits Genius wearing a monocle to remind us that justice is quite blind, and bearing a rolling pin to symbolize inspiration. Her rosy feet rest on a cushion of imperial purple; she is draped in diaphanous green tissue which hides not the fair rondures of her maiden form. From either hand the divinity is choired in dulcet strains; Ole on the left tosses off grace-notes from a harmonica; Mr. Arnal on the right with gusto twangs a harp whose bass strings boom near his ear and whose treble strings tinkle off at arm's length. (This is faulty harp technique, but Mr. Arnal realized that only a hind-foremost harp would fit the composition.) Juicy fruit, an oil can, and various still-life items litter the space at the foot of this grand scheme, while above flutter R. T. and R. C. Jones as bodiless cherubim in a cerulean sky. Still higher wing two angels, Saint Evelyn and Saint Edith, the latter blowing her own horn which, in ecclesiastical art, is a very rare posture for this modest saint.

MINERS

MINERS DOWN CHEMISTS, 26 TO 0

A football game between the School of Chemistry and the School of Mines took place on Saturday, November 10. The Miners piled up a score of 26 to 0. Four touchdowns and two goals after the touchdown comprised the scoring elements. Glick made two of them and kicked one goal after the down. Martain made a touchdown and kicked one goal after the down. Winters made a touchdown. Glick failed in two attempts to kick goal after the downs. Chuck Johnson starred for the Chemists with his brilliant passing game. The game itself was played in the Chemists' territory most of the time.

ADVENTURESOME MINER EMBARKS ON SEA OF MATRIMONY

About six weeks ago "Shorty" Sherman slipped out the back door of the Sigma Rho fraternity house with his trunk and was gone for five days and when he returned he brought back a wife. The bride was formerly Miss Gladys Dewey, of Crosby, Minn. The young people met at Crosby while "Shorty" was on the Sophomore Field Trip. Mr. Sherman is now a junior in the School of Mines and plans to finish school.

FRESHMEN RECEPTION

The traditional reception for the incoming freshmen was held October 17. This event is an annual affair held in order that the upper classmen may become better acquainted with the new men and give them a proper start in their college life. The reception takes the place of tea-fights, class scraps, etc., held in the other colleges. The evening started off with a few rounds of boxing among the various freshmen. This started the spirit of the party and nine freshmen were chosen to stage a "Battle Royal" for their individual honor. In order to keep the events moving some upper classmen took spare gloves and "socked" the poor freshmen at leisure. Time was taken out during the evening to elect Edwin Hennan to the Minnesota Union Board of Governors. Another bout and then the meeting adjourned to the assaying laboratory for refreshments. After all concerned had liberally gorged themselves the upper classmen and faculty lined up in two long files. The freshmen were made to run the gauntlet while each "socked" them to give them the proper start in the School of Mines. The reception was then closed while the men went out to follow old traditions of longer standing.

CHANGES IN FACULTY

At the end of the summer vacation two changes were made in the School of Mines faculty due to resignations. Mr. L. J. Webber is taking the place of Mr. C. M. Reasoners as instructor in Metallography. Mr. Raymond W. Allard is taking the place of Mr. L. S. Heilig as instructor in Mining. Mr. Heilig is now an engineer with the Minnesota Tax Commission.

ELECTRICALS

THE ELECTRICAL DEPARTMENT

The double E's got away to an overwhelming victory this last month. In almost the first moment of play through a smashing series of line plunges and end runs, they made a very considerable part of their total score. The particular occasion of this first score was a meeting of the Minnesota section of the American Institute of Electrical Engineers, at which R. F. Schuchardt, national vice president of the A. I. E. E. and electrical engineer of the Commonwealth Edison Company of Chicago, gave an exceedingly interesting and instructive talk on the organization, growth and present status of his company.

In speaking of the general aim of engineering, Mr. Schuchardt made the statement that "the real aim of engineering is not the deliverance of the world from work but from physical drudgery: work is essential to happiness. Present day culture is available to the masses only because of cheap power." He pointed out that as a result of engineering, coal consumption has been reduced from 7 pounds per kilowatt hour in 1880 to 2.37 pounds per kilowatt hour in 1920. He came to Minneapolis with a definite message to the students of the E.E. department, the general idea of which was not to confine ourselves to the purely technical side of engineering but to broaden out, to take a part in other activities such as economics, art, and civics. He emphasized the statement that we should know how to do our job and should learn the relation between our job and the whole problem. We should not stop studying when we leave school but should keep on improving ourselves.

A large majority of the senior Central Stations class was "among those present" to get the real world. It is sincerely hoped that they did; the information was all there. But what with coal consumption curves, per cent hydro load, peak loads and co-ordination, sub-stations, tie-lines, efficiency and cost curves, all in one dose, methinks that the members who were present were rather overcome with the greatness of the field as shown by Mr. Schuchardt.

That Minnesota played Wisconsin to a scoreless tie this year is now a matter of history but the support given the team by the double E's has not been recorded. On the Thursday before the game the absence of a few faces from their usual haunts was noted. The next day a much larger number were missing and by Saturday morning it was easier by far for the instructors to record the present members of the classes rather than the absentees. As to the manner of their going, and returning—that is closed to discussion as it might lead to trouble with railway officials, highway commissioners, sheriffs, constables and others. The main thing is that they were all present for the ceremonies on Randall field and aided in the festivities afterward. In fact, Friend Cass woke up at the break of dawn the next day to discover himself an inmate of the state insane asylum at Mendota.

On the return trip a party including the respected and dignified chairman of the student branch of the A. I. E. E. was stopped by the Chief of Police, Fire Marshal, Deputy Sheriff of Black River Falls. It was found that Mr. C. P. F. M. D. S. had stopped the wrong party, so to rectify matters (from angry to docile citizens) the mayor of the town invited them to his own house for a wonderful turkey dinner with all the trimmings, was very profuse in his apology, and begged them not to think too harshly of the town—at least according to Mac's story. At any rate all of the absentees returned during the course of the next week with tales of a wonderful trip.

Well, well, well! Our heartiest congratulations are due to the Junior class. In a recent membership drive of the A. I. E. E. the Juniors signed up 100%. Now that is quite some record for anyone to beat but here's hoping that the succeeding classes will tie the record. Welcome, Juniors, you are now with a real, live engineering outfit. Come to the meetings and see what we really are.

The first meeting of the year for the student branch of the A. I. E. E. was in the form of a welcome dinner meeting at the Union and came to pass on the thirteenth of November at the hour of six o'clock in the evening. The old standbys were all out to hear Prof. Ryan expound on his belief in the outfit. "Doc" Shepardson was there with his bit of usual sound advice and Roy Olson was back to help start us off with a bang. "Mac" didn't have a chance to say much, the speakers said it all for him—but cheer up "Mac," you are the chairman anyway.

It is with great pride that we announce to all and sundry that Al Greene, senior electrical and this year's football manager, has been elected All-Senior

PROGRESS ON THE NEW BUILDING

Well, gang, we were over to the building a couple of days ago giving her the monthly double O, so here's the latest: The brick work for the third and last floor is completed and the contractors have started to put up the steel work for the roof and are about ready to close it in. The moulds and about half of the supporting beams for the cement floors have been taken down in the main lab and on the first floor in the class room section of the building. The openings for the wiring ducts mentioned last month are now very much in evidence and the plumbing work has been started.

The steel work for the radio towers has been completed and the actual work of assembly will be started in a week or two. Cloth has very recently been put over the windows to keep the cold out in preparation for going ahead with the interior work. The latest news is that the general contract calls for completion of the building by May so that the actual moving in may be commenced before the close of school in June.

CHEMISTS

WILL YOU BE THERE?

It is a fact already well known that students in the School of Chemistry and in the other technical courses actually know very little about the vast field of chemistry and its wide application, not only in the chemical industry, but also in the various engineering, mining, medical and other sciences. Much has been said concerning methods of acquainting these students with the true importance of chemistry, but until the present time very little has been done to correct this defect in our educational sytsem.

For the above reasons, and also for the purpose of interesting students in other branches of science in chemistry, a lecture course on several phases of this science has been arranged. These lectures are being sponsored by Phi Lambda Upsilon, honorary chemical fraternity, Iota Sigma Pi, honorary chemical sorority, and Alpha Chi Sigma, professional chemical fraternity. They will be given at intervals during the coming months, and will be of a widely varying character. The committee arranging the course are attempting to cover as wide a field as possible, and thus to attract as many students from other schools as possible to these lectures.

The first of these lectures will be given on Tuesday evening, December 12th, in the Chemistry Auditorium, at 8 P. M. Dr. C. A. Mann, Chief of the Division of Chemical Engineering, will speak on "Chemical Problems in Mining and Engineering." While a subject such as this will attract practically every student in the School of Chemistry, it is hoped and expected that all engineers and miners, as well as others who may be interested, will also attend. Dr. Mann is very well known on the entire campus and it is certain that those who know him will attend.

The lectures to follow Dr. Mann's have been tentatively arranged, and the present course is as follows:

Dec. 12—"Chemical Problems in Mining and Engineering," Dr. C. A. Mann, Chief of Division of Chemical Engineering.

Jan. 8—"Chemistry of Farming and Farm Products," Dr. J. J. Willaman, Professor of Agricultural

Feb. 19—"Structure of the Atom," Dr. F. H. MacDougall, Chief of the Department of Physical Chemistry.

April 8—"Colloids," Dr. R. A. Gortner, Chief of the Division of Agricultural Biochemistry.

May 6—"Textiles," Dr. Ruth O'Brien, of Iowa State College, Ames, Ia.

The need of such a course as this has long been felt, both by the faculty and upperclassmen in the School of Chemistry. The lectures arranged for this year should be great successes, and it is confidently expected that in future years they will become a regular part of the education of both the chemist and the man in any science who really seeks a broad education.

BROTHERS MEET

The Little Brother movement in the School of Chemistry is meeting with wonderful success. A spirit of helpfulness has been taken up by the upperclassmen and as a result, the freshmen, or "little brothers" as they are now called, are finding the path of the freshman much softer than in years gone by.

The first general meeting of the Little and Big Brothers was in the form of a luncheon at the Minnesota Union on November 15th. The brothers who had not met before were brought into the fold and ways and means of making this phase of School of Chemistry life even more helpful were discussed. Then, to make the meeting even more brotherly, Prexy Jewett called on brothers at random and many good speeches (and a few not so good) were delivered in the impromptu manner.

This luncheon was only the beginning of a series, and it is hoped and expected that the fellowship which will be fostered by the movement will result in more upperclassmen in future years, and less heartbroken freshmen abandoning chemistry as a profession.

Vice President Les Johnson is to be congratulated on the success with which he is meeting in this movement. May he arrange many more such luncheons, and may the students in the School of Chemistry continue in the spirit which has proved so inspiring.

REDMAN OF REDMANOL

"The Art of Molded Plastics—Bakelite, Condensite and Redmanol." This was the title of a lecture given by Dr. Redman, of the Redmanol Company, on Wednesday evening, November 14, before a large audience in the Chemistry Auditorium. He had come upon the invitation of the Minnesota Section of the American Chemical Society.

Undoubtedly 90 per cent of the audience expected to hear a highly technical lecture. The same 90 per cent expected to learn very little about the plastics to be discussed because of their supposed secret nature. And the same 90 per cent was disappointed in both cases.

Dr. Redman spoke as a man, not as a machine, reciting a stereotyped lecture. His address was more of an informal discussion than anything else. He even went so far as to wander from plastics to the "condition of Africa in the time of Christ" and the tariff now in effect in this country. He told all that he thought his audience would be interested in—and he showed rare judgment—and then he willingly answered many queries.

Perhaps Bakelite, Redmanol, et al, are secret substances; but Dr. Redman did not seem to think so. He told how they were made, explained the chemistry of the substances, told of the many ways they were treated to make them usful in different industries, and in general disseminated information which might well be kept secret.

Perhaps some of us were disappointed that only faculty members and the members of the A. C. S. received Redmanol pencils, but at that I guess we all agreed that we received more than we had ever expected in the way of both information and entertainment.

May the Minnesota Section bring on many more such speakers!

MECHANICALS

A. S. M. E. HOLDS MEETING

The student branch of the A. S. M. E. held the first meeting of the year on October 23 in the Mechanical Engineering building. Mr. C. F. Eveleth of Warren Webster Co., Camden, N. J., spoke on "Heating and Ventilation." He emphasized the advantages of the vacuum system of steam heating. A system of this type eliminates water hammer, and the removal of air from the pipe lines is much more simple and rapid than in other heating plants. He also stated that the heat is easily controlled and exhaust steam can be used with very good results because of the low pressure required. The various types of automatic apparatus were illustrated by slides.

In the regular business meeting on November 3 the Technical Association was discussed and voted upon favorably. Prof. Rowley, who will attend the National Convention of the A. S. M. E., promised to represent the Minnesota student branch.

Stewart Willson, senior mechanical, fractured a vertebrae in his back during the football game with the Haskell Indians, and was in the Student Health Service for six weeks. "Stew" was playing quarterback, and was injured when tackled.

He has been prominent in athletics: a member of the track team '22, '23, elected captain of the '23 team, and was putting up a strong fight for a berth on the football team.

Following are some personal data on the new instructors in the Mechanical Department. All of these men have done practical work in large manufacturing companies, and some have had considerable experience teaching.

Mr. Lawrence F. Campbell, B.S. in Mechanical Engineering 1920, University of Wisconsin, put in one and one-half years in the Physical Laboratories of the Dodge Brothers Motor Co., Detroit, Mich., and the same length of time in the Power Department of the Kimberley Clark Co., Neenah, Wis. He is a member of the A. S. M. E. and Pi Tau Sigma.

Mr. John Flodin, University of California and University of Washington, received his Bachelor of Science degree in '13, and his M.E. degree in '19. He was with the Bethlehem Steel Co. for three years at Boston, Mass., designing ship and shipyard equipment. He taught general design and naval architecture for two years in the Y. M. C. A. at Seattle, Wash. Mr. Flodin is a member of the A. S. M. E. and the Society of Naval Architects and Marine Engineers, and has contributed articles to the Society of Naval Architects and Technical magazines. He is now teaching Mechanism and Design.

Mr. Thomas P. Hughes has charge of the Forge Shop this year. He has had a wide experience in this line, as he did heavy forging work in the Milwaukee Railway shops.

Mr. Ronald M. Hazen is a graduate of the University of Michigan with a degree of Bachelor of Science in Mechanical Engineering '22. The following year was spent in the Dynamic Research Section of the General Motor Research, Dayton, Ohio. He teaches Automotives and Gas Engines, and is a member of the A. S. M. E., S. A. E., Tau Beta Pi, and an associate member of Sigma Xi.

Mr. Dayton A. Rogers graduated from the Cass Technical High School, Detroit, Mich. He has taught Machine Shop Practice at Dunwoody Institute for three years, and was in the Experimental Division of the Burroughs Adding Machine Co. for one and one-half years.

Mr. Charles C. Sampson, Armour Institute, obtained his B.S. degree in '04, and his M.E. in '08. He was estimator and inspector for the National Packing Co., Chicago, for two years, with U. S. Steel, South Chicago, Joliet and Duluth for thirteen years, and ran a woodworking factory at Deerwood, Minn., two years. Mr. Sampson wrote an article, "Gas Power Plant Operation," published in the A. S. M. E. magazine.

Mr. C. Robert Egry, Purdue, B.S. degree in mechanical engineering '22, is instructor in Heat Engines and Heat Laboratory. He was on estimating and cost production work for the Maxwell Motors and Delco Light Co., and was also with the National Cash Register Co. He is a member of the A. S. M. E. and S. I. E.

CIVILS

THE INQUIRING REPORTER

He asks the same question of four different men.

QUESTION: What mechanical device do you consider most valuable to the enigneer?

ANSWERS:

Professor Parcel, Structures: The question is not an easy one and, it seems to me, does not admit of a categorical answer. Fundamentally I should say the wheel and axle has perhaps contributed more to mechanical progress than any other device. The lever might be mentioned of course, but the wheel and axle is a form of continuous lever, permitting propulsion of a load with greatly reduced friction. When you consider the almost innumerable ways in which the principle of the wheel and axle is applied in practically every machine and instrument you can form some conception of its indispensability to civilization. The unknown barbarian, who first devised it, undoubtedly did more to promote the material welfare of mankind than more recent inventors of much more complicated mechanisms.

Professor Cutler, Railways: The slide rule. See pamphlet 746, U. S. Patent Office; also Volume 9876, page 285, Proceedings of the American Society of Mechanical Engineers.

Professor Bass, Hydrology: Well, as far as Civil Engineering goes, taking the question at its face value, and leaving out of account such generally useful devices as printing and the microscope, both of which have a broad usefulness not restricted to engineering alone but apply to other pursuits as well, there are of course so many inventions that we make use of in engineering that it would be difficult to choose any particular one and say that it, rather than any other, is most valuable.

Professor Otto S. Zelner, Surveying: The greatest invention in the world was the wheelbarrow, because it taught the Irish to walk on their hind legs. Say, did you ever hear the one about the Swede undertaker?

"A TREATISE ON INDETERMINATE STRUCTURES," by Professors Parcel and Maney, is now in the hands of the publishers, John Wiley & Sons, New York, and will be on the market about March first. The book is intended for use as a textbook in indeterminate structures and as a reference work for designers and instructors.

Professor Maney, of the Civil Engineering department, is on leave of absence which will probably extend throughout the year. He is engineer of construction on a warehouse and office building job at Dallas, Texas. The office building is said to be the tallest reinforced concrete structure in the world. The architect is L. R. Whitson, a graduate of the School of Mines.

Mr. John H. Dunlop, Secretary of the American Society of Civil Engineers, found time in his tour of the United States to talk an hour to the Civils on November twenty-third. Mr. Dunlop is an excellent speaker and kept his audience's attention at high pitch while he outlined what engineers had accomplished in the past and what remained for them to do in the future.

The remarkable increase in material comforts and the consequent high standard of living in this country may largely be credited to the engineer, Mr. Dunlop said. For every person in the country there is seven and one-half horsepower to serve him. In transportation, one man by the aid of machinery does what it required 650 to do before the age of steam.

"The duty of the younger engineers is to measure up to the opportunities of the future," Mr. Dunlop said. "The engineer in the future must be more than a technical man. In the next ten years it is estimated there will be 40,000 executive positions to be filled, and engineers should fill half of them. The engineer in the future must be thoroughly trained in his own line and in addition he must have a broad training to fit him to be a leader."

The Physics Department will be interested in the following method for determining the mass of an object without the use of costly apparatus. It is the method used in Ireland for weighing pigs. In Ireland a pig is sold at a unit price per pound the same as elsewhere, so its weight must be accurately determined at the time of sale. The pig is taken out of its sty, or parlor or other habitat and placed on one end of a plank which rests on a fulcrum. A heavy stone is placed on the other end of the plank and moved back and forth until the plank balances. Then they guess the weight of the stone, and the pig of course weighs the same since the beam is balanced.

Farrington Daniels, Chemistry '10-'11, is now professor of Physical Chemistry at the University of Wisconsin.

TECHNICALITIES

THE LAST STRAW

Mr. Busiman was exasperated with the telephone. Ten times that morning he had tried to get a number and each time something or other had prevented him from speaking. At last he got through.

"Hello!" he said. "Is Mr. X there?"

"Yes," replied a voice. "Do you want to speak to him?"

That was the last straw. Back went the reply in icy tones: "Oh, no! I merely rang him up to hand him a cigaret."—Telephone Record.

Bill Jones, the constable, received a circular showing six different photographs of a man wanted for murder. Two days later he wired the Chief of Police, "Have five of the men. Am going after the sixth tonight."

Cost of chicken dinners depends upon number of chickens invited.

If it is true that a ditch digger only needs a vocabulary of 300 words, why teach Civil engineers English?

A foreman was taking a class of students through a locomotive manufacturing plant explaining the various processes of manufacture.

"To your right," he said, "are the engine boilers."

"Why do they boil the engines?" asked one fair listener.

"To make the engine tender."

Our old friend, Magnus Johnson, again crashes through with a vociferous "We got to have shorter hours, longer bars, bigger and better beers and ven ve got dot, by golly, den ve got everyting."

"Can you play all night long in A flat and B natural?"

"I can play all night in any flat if I have the right key."

He—Do you like my moustache?

She—Well, between you and me, yes.

"Her hair was long, her foot was light and her eyes were wild."

Moral—Bobbed haired girls don't have wild eyes even if their feet are big.

YOU KNOW!

It's wonderful to gaze into my eyes
And know that I'm all mine.

SOMETHING ON ACCOUNT

Two Yankees were in Cook's office at Cannes the other day for the purpose of turning some dollar checks into francs.

"Well, gentlemen," said the clerk, "if you will give me 50 centimes (2 pence) I can cash your checks in full without any small change being necessary."

A Scotchman who overheard the conversation and saw that the tourists were somewhat perplexed, neither of them having 50 centimes at the moment, stepped forward and produced the coin, saying politely:

"Great Britain owes America £900,000,000 and here I find two Americans in want of a little money. Please allow a Scotsman to make a contribution toward the liquidation of our debt."—Paris Daily Mail.

CAUSE FOR SUSPICION

Between stations in Pennsylvania a certain train came to a sudden stop with a tremendous grinding of brakes. Immediately a worried-looking man rushed down the track and demanded of the brakeman the reason.

"What is it?" he asked. "An accident?"

"Somebody pulled the bell rope," was the reply. "The engineer put on the brakes too quickly, and one of the cars went off the rails. We'll be tied up about four hours."

"Four hours!" exclaimed the passenger. "But I'm to be married today!"

Instantly the brakeman turned on him with suspicion.

"See here," he ejaculated. "you aren't the guy who pulled the bell rope, are you?"

Small Boy (at zoo)—"Oh, look, mother, the stork is trying to see if he remembers me."

The boarding house chicken still holds its place as the toughest bird in town.

An Eastern farmer, who had moved to California, had heard that his neighbor raised unusually large potatoes, so he sent his hired man over to get a hundred pounds.

"Go right back," said the Californian, "and tell your boss that I won't cut a potato for any man."

UP-TO-DATE DEFINITIONS
The Latest Renditions of Modern Slang

An oil can is a guy who leaves his rubbers on the radiator.

A slob is a bimbo who eats onions and then gets confidential.

A goof is a poor fish who borrows a cigaret and then gets sore because you haven't a match.

A dumbell is a guy who buys Herpicide to use on his hair.

A bimbo is a guy who blows his breath in your face after he has had some home-made hootch.

A futzenheimer is a gink who doesn't drink coffee because the spoon bothers his eye.

A pineapple is a goof who tries to get wholesale rates on two-cent stamps.

An egg is an oil can who starts to tell a joke and then forgets the point.

A yap is an egg who thinks that cold cream is kept in a refrigerator

CHRISTMAS TOAST

Here's hoping you all have those two great American birds—the Turkey on the table—the Eagles in your pocket.

Dearie, since you have went
My bitter tears have fell—
How lonesome I shall was
I cannot never tell.

A lot of time has went
Since I have saw your face,
And when you have came back
Don't never leave this place.

I have not yet forget
Them lovin' words you've spoke.
I knewed they wasn't meant,
But still my heart is broke.

You've left I all alone
You've came and went back again.
You've learnt me that I can't
Not never trust no men.

But maybe when you've wrote
And showed of me you've thunk;
I'll dry them bitter tears
And won't felt quite so punk.

She came tripping up the aisle
Dressed up so prim and neat,
I couldn't resist a girl like that;
I offered her my seat.

Soon after we went 'round a curve,
I did some antics fleet;
My little ideal curtly said,
"Get the hell off my feet."

IN HAVANA

A man walked into a cafe downtown, sat at a table and wrote as follows:

"Waiter, give me a Scotch Highball."

After drinking it he wrote:

"Give me another."

Then, having finished, wrote again:

"Give me another."

This one being disposed of, he wrote:

"How much do I owe you?"

The waiter read it and wrote on the pad:

"You owe nothing. We don't charge deaf and dumb people for drinks."

The man read this, then glared at the waiter, and roared:

"Hell! I'm not deaf and dumb! I just came in from Key West and was so dry I couldn't speak."

Laffin' is the sensation of feelin' good all over but showin' it particularly in one spot—Josh Billings.

Statistics are wonderful things. If all the slide trombones made in this country since 1875 were made into one large trombone—it would be a good thing, because there wouldn't be any-

THE AMERICAN OUTCLASSED

The American truth teller was in form. "Talking of ants," he said, "we've got 'em as big as crabs out west. I've seen 'em fight with long horns, which they use as lances, charging each other like savages."

"They don't compare with the ants I saw in the Far East," said an inoffensive individual nearby. "The natives have trained them as beasts of burden. One of 'em could trail a ton load for miles with ease. They worked willingly, but occasionally they turned on their attendants and killed them."

But this was drawing the long bow a little too far.

"I say, old chap," said a shocked voice from the corner, "what sort of ants were they?"

"Eleph-ants," replied the inoffensive individual.—London Tit-Bits.

PAGE THE OLD SCRATCH

The daughter of a certain strict principled old deacon had attended a dance the previous night, much against her father's wishes. When she appeared for breakfast the next morning he greeted her with the words:

"Good morning, daughter of the devil."

To which the maiden respectfully replied:

"Good morning, father."

—Jack o' Lantern.

DIPLOMACY

He didn't know just how to begin. The taxi was moving fast with the meter keeping time. He was losing precious coin and possibly precious minutes. At last he hit upon an idea!

"Er — are you — er — interested in politics?" he asked.

She looked at him in half-veiled disgust.

"Of course not!" she sniffed.

"Well, I was just wondering whether you were a conservative or a liberal," he explained.

He wasn't as dumb as she thought he was.

—Brown Jug.

AFTER THE BALL WAS OVER

She—"This taxi is going fast."

He—"Yes, it is."

She—"Mother never lets me invite my escort into the house after dances."

He—"No?"

She—"No." Silence. "We're almost home."

He—"Yes."

She—"Yes. We'll soon be home and mother always stays up and waits for me and makes me come right into the house."

He—"Zat so?"

She—"Yes. I'll have to leave you at the door."

He—"You will?"

She—"Yes," Silence. "We'll soon be home. Isn't this a cold night! Brr. It's cold riding."

He (not a word).

She—"Brrh * * * Brrh * * * Brrh! Brrh!"

He (not a word).

She—"We're almost home and I'll have to leave you at the door."

He—"You will?"

She—"Yes * * * I'm cold * * * We're almost home—Brrh! * * * Say, when in hell are you going to kiss me?"

SO SPAKE SOLOMON

My son, incline thine ear unto me, that ye be not out of town.

For the lips of a gold-digger are as Bryan and Volstead, they stoppeth every good thing.

Remove thyself far from her for she wants only thy shekels.

For I was, in my youth, a sap, and the wise men said that I was out of town. Young was I, and did not know my oats.

And there came into Jerusalem from a far land, one who was decked in fine raiment, and she smelled of Woolworth's.

With her came musicians, the like of which were never heard in all Israel. Verily, they hit a hot timbrel and knocked a mean cymbal.

I threw myself and ten thousand shekels at her feet, and the latter were acceptable in her sight. I promised her the temple for the sweets of her lips, and she asketh for the temple first.

But as the lamp post foxes that which is soused, so foxed she me. And as Willard knew not that which kicked him a jab to the chin, neither knew I that I was being played for a fish.

And her name was Sheba, with her, my wives looked like the W. C. T. U. compared with Gilda.

I gave her all the camels in Israel, and she smoked them all. And she did also empty my cellar of its contents and my strong box of its shekels.

But I was young, and knew not that I was out of town.

But can a man drink synthetic gin and walk abroad again?

And I sold all my wives to buy more camels, and the temple I mortgaged to the Philistines.

As the bar room looks after a raid, so looked I. Verily, I was a plugged nickel.

And when she had all my possessions, she gave me the gate and returned to her land.

So, my son, be not out of town. For the gold-digger tricketh, and the dumb-bell believeth.

He that is out of town, gets it in the neck.

—Purple Cow.

BESIDES, SHE WAS COVERED WITH GLORY

Anthony—Cleo, m'dear, I can't afford to buy you a new string of beads.

Cleopatra—Come across, old dear—'twill save the price of a new gown.

—Sun Dial.

My girl on the sofa's efficient
At petting she's very proficient
But my head's in a whirl,
For I've lost my girl.
A word to the guys was sufficient.

—Moonshine.

Experiment No. 2
STEAM ENGINE INDICATORS
Nov. 20, 1923

Object: To become familiar with indicator card characteristics.

(Note—Due to a change in sections, Mr. Carlson and I were assigned to this experiment without opportunity to read on it.)

Apparatus: The engine used was the small one near the center of the east side of the laboratory.

Procedure: A casual examination revealed a liberal supply of rust in its

ket material here and there and a broken valve in the exhaust line.

Making the best of these minor deficiencies we turned on the steam and, with our trust in heaven and our hearts in our mouths, cautiously opened the throttle. After considerable coaxing on our part and considerable hoazing on the engine's part, it commenced to revolve. Its motion was characterized by the same savage hissing and wheezing and the same stately rattle that characterized the performance of the railway locomotives during the summer of 1922. It appeared to be afflicted with asthma, string halts and blind staggers; perhaps the result of infantile paralysis.

We lubricated all bearings with gas engine oil. We shut off steam and poured cylinder oil in through the indicator valve allowing it to run down into the cylinder.

We drew out an armful of indicators from the tool room, found one that would fit and returned the rest.

To avoid filling the indicator with cylinder oil, we started the engine (now running more smoothly), opened the indicator valve and took cover during the lubrication of the roof trusses.

The indicator was then attached, using a 16-lb. spring, and by 12:10 we emerged triumphantly from a heap of waste paper bearing an indicator card in one piece. This will probably be found attached to Mr. Carlson's report. It represents a setting for equal valve travel on each side of the midpoint.

Respectfully submitted,

____

Nurse—"The stork arrived and it's a girl!"

Father (with keen foresight)—"And I just sold the porch swing."

It does not require a magician to turn a flivver into a lamp post.

"Is it possible to confide a secret in you?"

"Certainly. I will be as silent as the grave."

"Well, I have pressing need for two dollars."

"Worry not. It is as if I had heard nothing."

SEVEN AGES OF WOMAN

Safety-pins
Whip-pins
Hair-pins
Fraternity-pins
Diamond-pins
Clothes-pins
Rolling-pins.

—The Harvard Crimson.

Boy: "Oh, mamma, look at that man with white pants."

Mother: "Shh! They are his flannels, dear."

Boy: "But, mama, father's are red."

—Pelican.

"Uncle, can you keep a secret?" asked little Willie.

"Yes."

"Well, Auntie eloped with the chauffeur, and they borrowed your car."

—Exchange.

He—"Where did you do most of your skating while learning?"

She—"I think you're horrid."

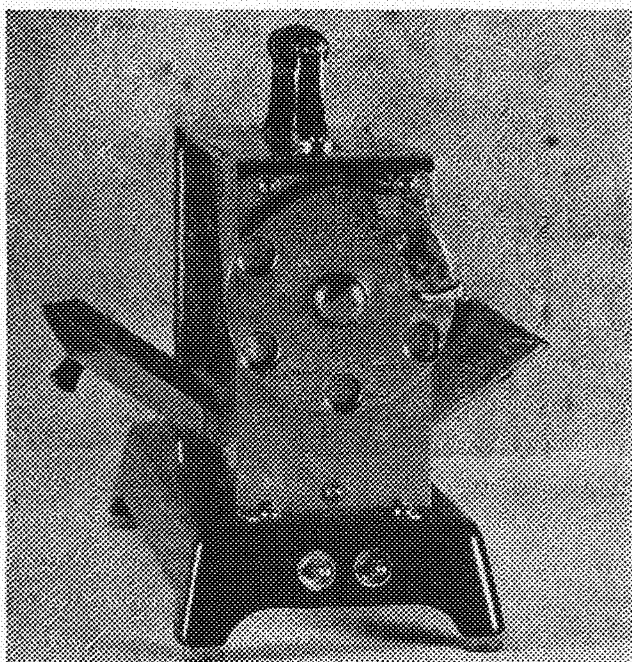
AN AUTOMATIC TOASTER

One of the few objections to the modern electric toaster is that the bread is burnt unless it is watched very closely.

The cut herewith shows an interesting improvement in electric toaster design, the purpose of which is to eliminate burnt toast.

This device is the invention of Mr. Dayton A. Rogers, instructor in machine shop practice at the University.

The main toasting element is of the standard type with the controlling device shown built on



one end. As may be seen there is a dial with four holes, each distinctly lettered, reminding one of an automatic telephone.

Suppose one wants to toast some fresh bread. He places the slices in the wings of the toaster and dials "Fresh Bread." The dial revolves back to normal very slowly, being retarded by a simple mechanism in the case. When the dial is at normal the toast is done and the wings are automatically tipped back. The bread is turned over and the dial is again revolved.

The holes in the dial are lettered: Dry Bread, Fresh Bread, Medium Fresh and Extra Fresh. The hole nearest the top is for dry bread.

Compared to an automatic telephone the operation of this device is extremely simple, since the dial need only be given two turns for two slices of bread.

The controlling mechanism has no springs to wind or electrical contacts to cause "shorts." It is entirely mechanical and tightly enclosed for protection.

The body of the appliance is highly nickeled and the base is enameled black, giving a very neat appearance. The base is also heavy enough to counteract any tendency for the toaster to tip when the dial is revolved.

Harold Peckham and Edward V. Brossard are taking the Cadet Course in the St. Paul Gas Light Co., and Raymond Ascher is enrolled in the Students' Course of the Bethlehem Steel Works.

COMING—NEXT JANUARY

So many prominent and eminent men have come to Minnesota in recent years that we are becoming accustomed to hearing big names and ignoring them. Convocations are poorly attended and most lectures are similarly treated. It is refreshing, then, to know that we shall soon have a convocation which will really be attended.

Who has not heard of Slosson—the scientist? Is there a technical student who has not read "Easy Lessons in Einstein" and are there any chemists who have not read that famous book, "Creative Chemistry"? If so, they are difficult to find.

Well, Dr. Slosson has been secured by various campus organizations to address an all-science convocation some time in January—probably the twelfth.

Will there be a vacant seat at this convocation—MAYBE!

J. G. HOLLAND DEAD

J. G. Holland, Civil Engineering '04, who had been employed as designing engineer with Holabird & Roach, Architects and Engineers of Chicago, died suddenly last August. At the time of his death Mr. Holland was in charge of the design of the new Nicollet Hotel in Minneapolis.

The following men of the Civil Engineering class of 1922 held a reunion at the Minnesota Union on Friday evening, November 16:

N. S. Anderson and C. L. Swanson, who are both in the Minneapolis office of Schuett-Meier Co., Structural Engineers.

Oliver A. Stoutland, who is in the estimating department of the Minneapolis Steel and Machinery Company.

J. F. Keller, who is in the bridge department of the Great Northern Railway.

E. H. Adams, who is engaged in building contracting with the firm of E. M. Ganley Company, Inc.

S. R. Cray and Leo Buhr, who have been engaged by the Byllesby Company on the St. Croix project above Taylors Falls since last spring and have been transferred to similar work on the Mississippi river with headquarters at Monticello, Minnesota.

E. J. Soshink, who is employed by the Crown Iron Works as estimator and designer.

E. C. Erickson, who is designing engineer in the bridge department of the Soo Line railroad.

L. F. Pinska, who is employed on municipal work by L. P. Wolff, Consulting Engineer, St. Paul.

T. S. Paulson, who is with Foley Bros., Contractors, in St. Paul.

H. E. Cribbs, who has recently left the bridge department of the Northern Pacific Railway and is now with the Minnesota Highway Department.

John S. Schlenk, Civil Engineering '23, and C. A. Wilson and C. H. Fennstrom, of the class of '21, who are engaged on hydraulic surveys and investigation for the Phoenix Utility Company, of Duluth, were in the city for the Iowa game.

Harry H. Angst, Mines '05, is now the superintendent of the Maroco Mine at Ironton, Minn.

F. W. Wilson, Electrical Engineering '23, is engaged in the students' training course of the General Electric Company at Schenectady, New York.

C. M. Burrill, Electrical Engineering '23, is employed in the radio department of the General Electric Company, of Schenectady, N. Y.

FAMOUS ETCHER AT MINNESOTA

(Continued from page 9)

castle or a cathedral, built in the days of banditry, the little villages look much like a carving by Rodin. The houses, half cave, half house, start from the drab stone of the ground and rise into the sky with no apparent break and resemble the cliffs themselves in shape and color, while the roofs, generally of warm reddish tile, lend pleasing spots of color to the mass.

Prof. Burton has an apparently inexhaustible supply of queer stories and exciting incidents to relate, concerning his eventful trip. One of the more unusual tells of a village far from the paths of travel which he found completely equipped with electric lights, apparently the only trace of modernism in the village, for in the doorways sat women weaving on looms centuries old, and nowhere could he find any signs of the villagers having adopted any modern device for the saving of time or labor. Apparently some development company, running electric cables from the mountains to some large city, had equipped this place with electric lights, the people having accepted them with indifference, left them burning day and night with no further thought about them.

The stories of the Easter Festival at Lorka, which festival resembles to some extent the Passion Play at Oberammergau, Germany, relate how the peasant women of the village spend their entire spare time for a year preparing biblical costumes for the characters of the pageant. Great amounts of effort and care are used in embroidering them with most splendid designs, and immediately one festival is over work is begun on the next.

Being caught in a fire in a hotel in Segovia, a town that had no fire department of any kind and very little available water, Mr. Burton was forced to remain on the fourth floor with no apparent possible means of escape, while the peasants carried water in jugs to squelch the flames. Only the construction of the hotel saved him, for the walls were of thick timber filled with plaster, and the fire burned out on the lower stories without doing more than destroy the furniture and scorch the ceilings, but it was a trying time for Mr. Burton, and I doubt whether there are very many of us who would be anxious to play the role of the boy who stood on a burning deck, even if the deck were of Spanish construction.

Still other stories of Moorish fetes, which greatly resemble our own western rodeo, but where the actors were Arabs who rode magnificent horses, and demonstrated their great skill with fire-arms by piercing targets while riding at full speed or whirling madly on rearing horses. It was spectacular but looked rather risky for the spectators, according to Mr. Burton, who prefers the gorgeous pageantry of the bull fight arena, with its brilliant matadors each vieing with the others to win the greatest applause from the onlookers, and risking a terrible death in attempts at more and more spectacular plays. These, and the stories of Spanish cave dwellers, the Sultan of Morocco, the studio of Zuloaga, the master painter, are but a few of the great fund of interesting stories acquired on his recent and fruitful journey, that can only be fully enjoyed when told by the traveler himself.

It is not necessary to speak of Mr. Burton him-

him to lecture and talk are always kindly received and many have heard him speak. And anyone who has heard him will vouch that if there is any one thing that he does better than draw, it is talk, and to meet him once is to be always interested, for the man is as charming as his work and as gracious to friends and visitors as though his entire time was at their disposal. Those fortunate enough to know Mr. Burton personally feel that his recent successes are mere forerunners of what is to come as he works quietly with thought only for artistic merit. Success has not been sought but forced upon him.

SHOULD AN ENGINEER BE CULTURED?

(Continued from page 12)

appearing in the curriculum. The advantages of a comprehensive study of accounting and business law are obvious. No sort of engineering work or business can be carried on successfully without an adequate system of accounting. As a business grows in magnitude, and as competition becomes more acute, it becomes essential to know accurately what is the cost of each unit constructed, and how that cost is divided. Accounting can be taught very successfully in the colleges and it is an interesting and essential part of an engineer's education.

Questions of law appear continually in any engineering enterprise. Scarcely an undertaking is entered upon without numerous contracts. Workmen's compensation in accident and sickness is often a troublesome question. Insurance, rights of way, water rights, these are all questions that a knowledge of the fundamental laws will help to solve.

Economics and finance are difficult to teach in college. Aside from the fact that the subject does not relate to the student's experience and hence is not especially interesting, there is a wide diversity of opinion on economic theories, even among recognized authorities. If it is attempted to teach more than the bare outlines of the subject there is an excellent chance for the student to learn false or impractical theories that may work great harm. Nevertheless, courses which include a statement of economic problems, and the recognized solutions as they have thus far been worked out, are valuable, in fact, nearly indispensable.

Courses teaching modern business methods cannot but be of value to the engineer. As the engineering graduate now leaves school he is innocent as the babe unborn of even the most common tools and conveniences of commerce. Exchange, bank credits, collateral, these and many more, are terms he meets on every side the meaning of which he has yet to learn.

In general it can be said, then, that there is a great value to the engineer in a mastery of English, and an acquaintance with the best literature, a somewhat lesser value in a knowledge of history and languages, and but little value to the engineer as such in the study of the arts. Economic subjects are of great importance.

I would conclude with a plea to engineers to study these cultural subjects, not only for the knowledge applicable to engineering, but also for the effect that that knowledge gives in increasing a man's value as a man, as a citizen and as a fellow engineer.

OUR MINERS TOUR THE WEST

(Continued from page 6)

The copper smelters at Garfield and the concentrating plants at Magna and Arthur were next visited. These are among the largest copper plants in the world. Bill Tinlander was very philanthropic, distributing the remainder of his lunch among the truck drivers we passed on the way back to town, much to the surprise of some of the recipients. Before leaving Salt Lake we visited the largest customs lead smelter in the world at Murray.

Park City, Utah, our next stopping place, is one of the largest lead-silver mining camps in the west. The trip to Park City was made by bus and as it was rather early in the year, and the roads had only recently been opened up, the trip through some of the mountain passes was a thriller. We were welcomed to the city by the sheriff, but he didn't know where we could get any and gave us to understand that he was on the same kind of a hunt himself. Several of the boys attempted to attend a high school play that evening but were given to understand that their support was not needed. Perhaps the authorities also owned the so-called opera house, as that was the only place of entertainment left to us.

All the large mines in Park City were visited during our stay and by the end of the week the hill leading to the mines was getting mighty steep. Also, if it had been much wetter underground we would have had to use diving suits. No one was lost during the underground explorations although several of the party strayed at one time.

By the end of the week we were all more than willing to leave for Salt Lake, where we spent a very enjoyable week-end. The following Monday we again left the town-of-no-owl-cars and spent the remainder of our trip in and around Eureka, Utah. There are several large lead-silver mines in this district. Here also the companies were very willing to let us in and spared themselves no trouble in showing us their properties. The boys, however, were getting rather tired and had forgotten many of the rules of this game of hide-and-go-seek, so can, possibly, be excused for getting lost one morning.

One of the chief points of interest was the Tintic Standard mine at Dividend, Utah. Being only five miles distant from Eureka, the trip was made in a company truck. Many thanks to the company for the transportation as otherwise we might have walked, but one of these steel bottomed trucks isn't the most comfortable method of travel over rough mountain roads. The Tintic Standard mine is right next door to the place of eternal fires. Temperatures as high as 167° F. are registered in some of the workings. The miners seldom wear more than pants and shoes while on duty. This mine is one of the richest silver mines, some of the ore running as high as 1,700 ounces of silver per ton. For many years very few people had any faith in the probability of ore being found on the Tintic's properties but it has since proven to be a bonanza. We returned to Eureka in the same truck, most of us having learned by experience, and had something easy to sit on during the ride.

The following morning a trip was made to Silver City, Utah, and an inspection made of the Silver City Milling Company's plant. We saw the mill but have been unable to figure where Silver City was the day we were there. We managed, however, to locate a pool room where Professor Pease treated the crowd to ice cream while waiting for the train.

On arriving at Eureka shortly after noon, the "gang" was disbanded and the trip was over. Those of us who were lucky enough to have made previous arrangements for further transportation, departed for other localities, though many of the bunch stayed at Dividend most of the summer. Dividend and Eureka had one marked advantage regardless of the cactus and sagebrush: Salt Lake was only ninety miles distant and a very pleasant time could be had there. Saltair is a wonderful place on summer evenings and their scenic railway has a thrill for all and offers many a corpulent opportunity.

FORD GETS BUSY AT THE HIGH DAM

(Continued from page 10)

topped by a heavy horizontal reinforced slab of concrete designed for the floor mounting for the generators. All of this had to be removed before new construction could be started.

Since the above picture was taken considerable advance has been made in the work. The new walls have been poured and the new generator bases have been put in. Due to the nearing of the cold weather every effort has been made to get the power house far enough along that operations may be continued throughout the winter. As a result the steel framework is now in place, the roof trusses are up and the building is rapidly being enclosed.

Another point of interest in this development is in the special type of hydraulic dredge that is being used to excavate for the tail race. The machine is equipped with a long suction arm at the end of which is a set of large rotary knives. These knives bite their way down through the bed of the stream cutting out chunks of shale six inches or more in diameter with apparent ease. To date, only about half of this phase of the work has been completed.

The units to be installed at the plant are 4,500 KVA Westinghouse Vertical Type generators equipped with Wellman Seaver Morgan Company's water wheels. These wheels use the Francis type of runner. The machines are to supply the line feeders at 13,200 volts. This is to be supplied to a substation located in the manufacturing plant proper where it will be stepped down to 440 volts and supplied to the various motors throughout the plant at that voltage. The feeders of the Northern States Power Company are supplied at 13,800 volts. When it is necessary to sell the surplus power to this company as called for by the Federal license it is planned to speed up one of the generators to overcome the discrepancy between the normal operating voltage of 13,200 volts and the N.S.P. feeder voltage of 13,800.

The waterpower equipment is to be supplemented during the season of low water in the river by an auxiliary steam plant to be built about a half a mile down stream from the dam. This auxiliary plant will be equipped with one 4,500 KVA unit similar to those used in the hydro plant and is to use two 1,500 HP boilers supplied with pulverized coal.

Some very interesting figures on the flowage and available power at the dam were published in an article on the High Dam by Prof. G. D. Shepardson, head of the electrical department at the University, in the TECHNO-LOG for March, 1922. It is pointed out in this article that from 8,800 to 10,000 KW can be expected at the switchboard for seven months of the year and from 10,000 to 11,000 KW or more for the rest of the year. The normal operating head is 34 feet.

The author wishes to express his appreciation of the valuable aid and information given him by C. M. Cowan, superintendent of construction at the dam for Stone & Webster, the general contractors.

CIVILS HOLD IMPORTANT POSITIONS

(Continued from page 7)

Austin Company, Philadelphia, Pa. E. L. Higgins, '92, is at present mayor of Hutchinson, Minn. F. H. Klemer is president of the Faribault Woolen Mills, Faribault, Minn.

A few alumni are at present Consulting Engineers. F. C. Shenehon, of the class of 1900, is a consulting hydraulic engineer. W. S. Dawley, '79, is a consulting engineer also.

Some have gone into highway work. H. B. Childs is county engineer for Anoka County, Minn. J. T. Eliassen is assistant commissioner of highways for the state of Minnesota.

From this brief resume of the work of Minnesota Civil Engineers it may be plainly seen that a good number of them are well known in the Engineering world, and it's up to the future Civils to see that this reputation that the alumni have established is upheld.

PENN ARCHITECT WINS BEAUX ARTS PRIZE

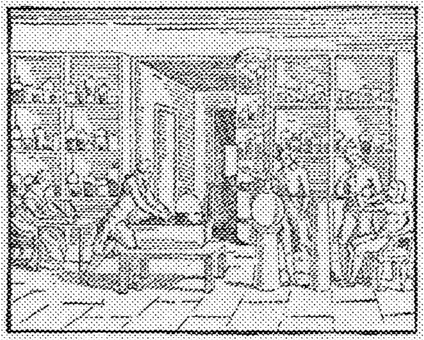
The Paris prize of the Society of Beaux Arts Architects, which is a scholarship given by the society, amounting to $3,000, entitling the winner to admission to the advanced class at the Ecole des Beaux Arts in Paris, was awarded to Leo Rombotis, of the University of Pennsylvania. The subject was, "An Office and Reception Building for the President of the United States." Second place went to K. H. Bieg, of the Department of Architecture of Armour Institute of Technology, Chicago; and third place to I. J. Loebl, of the Armour Institute.—Towne Scientific School Journal.

ARCHITECT'S SPECIFICATION HANDBOOK

This handbook has been developed by the Truscon Laboratories as a result of their long experience in the manufacture and use of Waterproofings and Waterproof Paints and Varnishes, and is intended primarily for the use of Engineers and Architects, containing the information they require when specifying Waterproofings, Dampproofings, Oilproofings, Floor Hardeners and Protective finishes. Architects and Engineers may obtain a copy of this Handbook by communicating with the Truscon Laboratories of Detroit, Mich.—Published by the Truscon Laboratories, Detroit, Mich.

OVERHEARD DURING REGISTRATION

"The only thing wrong with Wisconsin," said the upperclass-man to his frosh friend, "is that the faculty has too much to say about how things are run." —Wisconsin Engineer.



ANTOINE LAURENT LAVOISIER
1743-1794

Born in Paris, son of a wealthy tradesman. As a student won a prize for an essay on lighting the streets of Paris. Held various Government posts. A martyr of the Reign of Terror. Founder of modern chemistry.

They couldn't destroy the work he did

"The Republic has no need for savants," sneered a tool of Robespierre as he sent Lavoisier, founder of modern chemistry, to the guillotine. A century later the French Government collected all the scientific studies of this great citizen of Paris and published them, that the record of his researches might be preserved for all time.

Lavoisier showed the errors of the theory of phlogiston—that hypothetical, material substance which was believed to be an element of all combustible compounds and to produce fire when liberated. He proved fire to be the union of other elements with a gas which he named oxygen.

Lavoisier's work goes on. In the Research Laboratories of the General Electric Company the determination of the effects of atmospheric air on lamp filaments, on metals and on delicate instruments is possible because of the discoveries of Lavoisier and his contemporaries.

This is the mark of the General Electric Company, an organization of 100,000 men and women engaged in producing the tools by which electricity—man's great servant—is making the world a better place to live in.

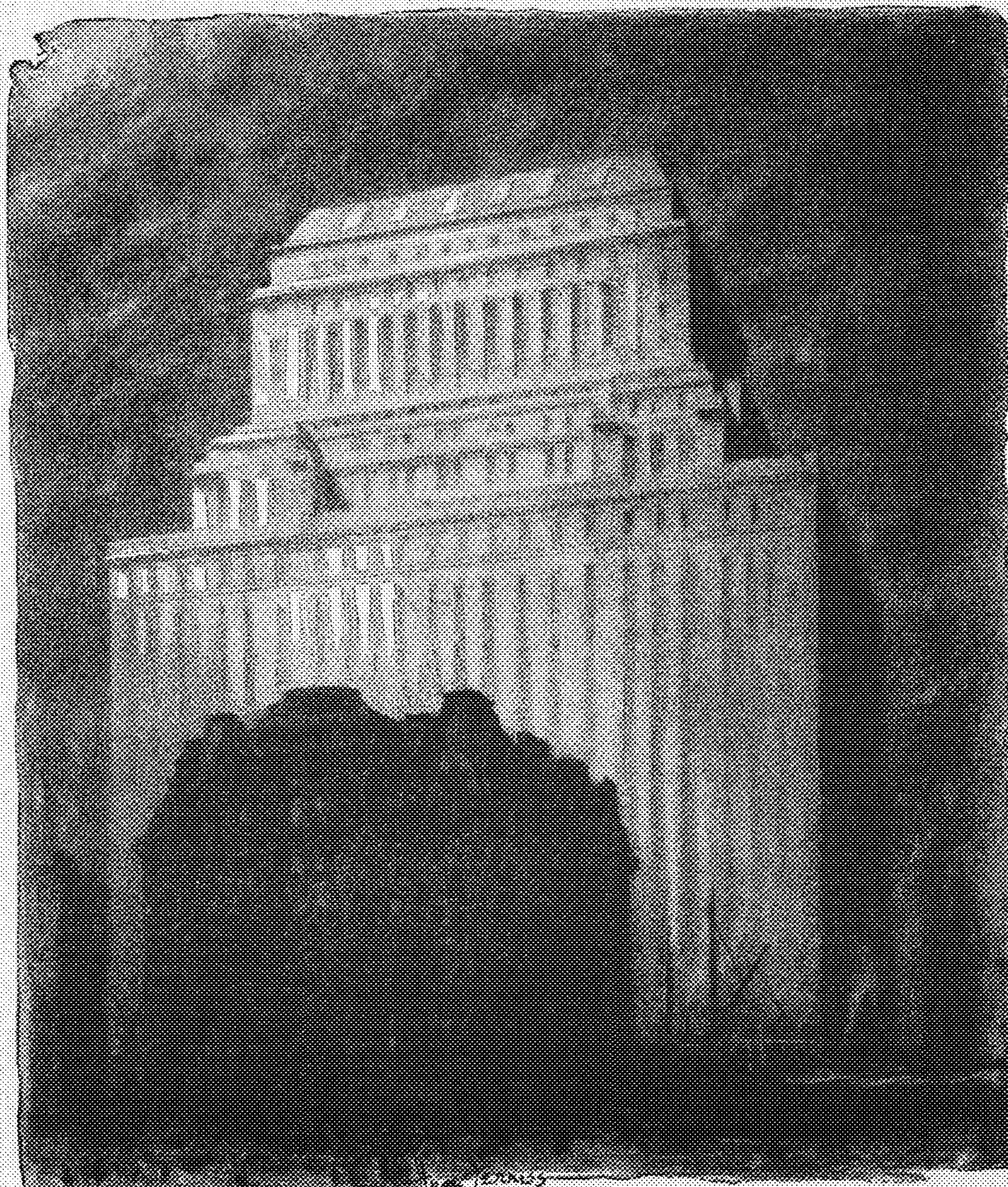
GENERAL ELECTRIC

MINNESOTA TECHNO-LOG

VOL. IV. NO. 3 JANUARY 1924

Published Monthly During the School Year
by the Students of the College of Engineering
and Architecture, School of Chemistry
and School of Mines of
the University of
Minnesota

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED



© O. E. CO.

The Fisk Building
New York City

CARRÈRE & HASTINGS
Architects

"Designing in Masses"

THE new architecture transcends detail and expresses the component solids of the great buildings of today and tomorrow. Gigantic profiles are reared against the sky—true expression of structural facts has now come into its own in architectural design, linking architect and engineer ever more closely together.

Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

OTIS ELEVATOR COMPANY
Offices in all Principal Cities of the World

BRINGING MORE DAYLIGHT INTO INDUSTRIAL BUILDINGS.

Dr. George M. Price, writing on "The Importance of Light in Factories," in "The Modern Factory," states: "Light is an essential working condition in all industrial establishments, and is also of paramount influence in the preservation of the health of the workers. There is no condition within industrial establishments to which so little attention is given as proper lighting and illumination. Especially is this the case in many of the factories in the United States. A prominent investigator, who had extensive opportunities to make observations of industrial establishments in Europe as well as in America, states: "I have seen so many mills and other works miserably lighted, that bad light is the most conspicuous and general defect of American factory premises."

"My own investigations for the New York State Factory Commission support this view. In these investigations it was found that 36.7% of the laundries inspected, 49.2% of the candy factories, 48.4% of the printing places, 50% of the chemical establishments, were inadequately lighted. There was hardly a trade investigated without finding a large number of inadequately lighted establishments."

Inadequate and defective lighting of industrial buildings is not confined to the establishments in New York State alone. The same conditions prevail in most sections of the country.

Such conditions as mentioned above are entirely opposed to the laws of health, sanitation and efficiency. Wherever poor lighting conditions prevail, there must be a corresponding loss of efficiency and output both in quality and in quantity. American industry is not using nearly enough daylight and sunlight in its buildings. Every endeavor should be made to use as much as possible of daylight for lighting purposes. To obtain this it is of course necessary that the rays of daylight and sunlight are permitted to enter the interior of the buildings as freely as possible, with the important modification that the direct rays of the sun must be properly diffused to prevent glare and eyestrain. A glass especially made for this purpose is known as Factrolite, and is recommended for the windows of industrial plants. Windows should be kept clean if the maximum amount of daylight is to pass through the glass, but the effort will be well repaid by the benefits secured.

In the presence of poor lighting, we cannot expect men to work with the same enthusiasm as when a well lighted working place has been provided. The physical surroundings have a deep effect upon the sentiments of the employes, and where bad working conditions are allowed to prevail, there is invariably a lessening of morale and satisfaction created thereby. Neglecting to utilize what nature has so bounteously provided, daylight, and which is so essential toward industrial efficiency, we have an instance of wastefulness, but now that the importance of good lighting is becoming recognized, undoubtedly more attention will be given by progressive industrial employers to furnishing the means which are essential for their workers to secure and maintain the efficiency, which counts for so much in the success of any industrial concern in this competitive age.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

MISSISSIPPI WIRE GLASS CO.,
220 Fifth Avenue,
St. Louis. New York. Chicago.
No. 3.

INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

Published and Copyrighted Monthly by

The Engineering Students
of the
University of Minnesota

Main Engineering Building, Minneapolis, Minn.

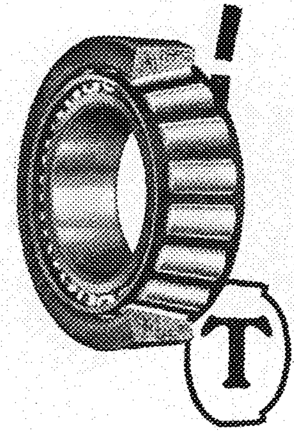
Subscription $1.50 per year — Twenty-five Cents the Copy

VOLUME IV — JANUARY, 1924 — NUMBER 3

TABLE OF CONTENTS

All Loads

TIMKEN
Tapered
ROLLER BEARINGS



Another phase of Dual-Duty capacity in Timken Tapered Roller Bearings is their ability to carry *all* loads—radial, thrust, resultant—at *all* speeds.

Evidence of this is found in the ever-increasing use of Timkens, for example, in the pinion mountings of motor cars, a location in which full motor speed must be sustained by the bearings under unusually severe conditions of radial, thrust, resultant, and shock loads.

Likewise in the machine tool field Timken speed capacity is favored for grinders, band saws and other high speed machinery.

In fact, in every phase of industry engineers are specifying Timken Tapered Roller Bearings in ever-increasing numbers—

(1st) not only because no conditions of load or speed are more than a match for Timkens;

(2nd) but also because Timkens carry maximum load per unit of space required, simplifying and economizing design;

(3rd) and finally because Timkens permit initial excellence of operation to be maintained for the life of a Timken-equipped mechanism, through Timken *adjustability* for the wear that must follow motion.

These Timken characteristics will likely be of major interest to you in years to come, when designing or operating problems arise in your experience, which can be completely solved only by the use of Timkens. As is the case with engineers of today, the sheer ability of Timken bearings will make you glad to contribute to ever-increasing Timken dominance.

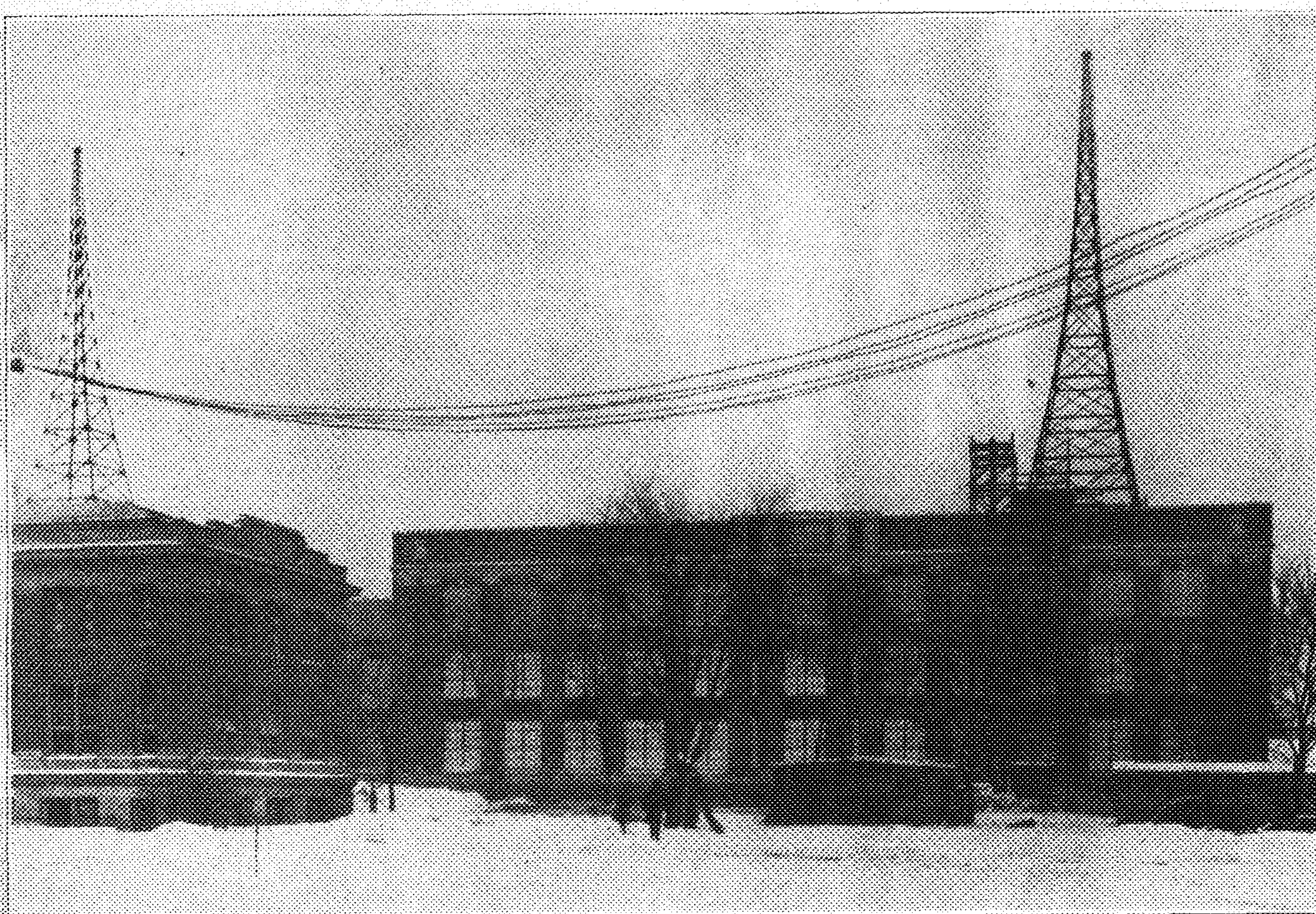
The Timken Roller Bearing Co
CANTON, OHIO

All Speeds

MINNESOTA TECHNO-LOG

University of Minnesota

VOLUME IV JANUARY, 1924 NUMBER 3



THE COMPLETED ELECTRICAL UNIT

New Construction Features and Functional Plans Make Building the Best of Its Kind

By C. W. Teal, E. E. '24

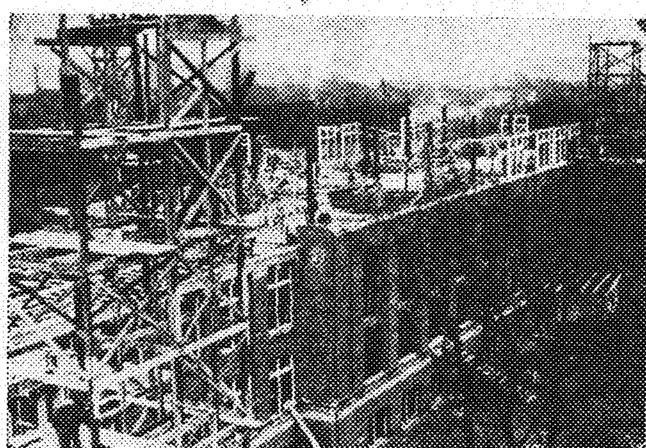
THE completion of the new electrical building, now under construction, will mark the attainment of another step in our ten year building program. Not only that, but it will mark the end of a long struggle for new quarters with adequate laboratory, lecture, and office space in which the men can turn around without barking their elbows. The building will be modern throughout and will embody several features absolutely new in the construction field as well as in the electrical field.

The location, which is just north of the Main Engineering Building, might best be described as between and under "those two big radio towers over there." The front of the new unit is on a line with the front of the main building, with the laboratory extending back in the direction of the Experimental Engineering Building. The ultimate plans call for a building with a frontage of 230 feet, practically the same as the Main Engineering Building, the present unit having a frontage of 70 feet and a depth of 275 feet (or 300 feet if the outside steps be included). The future northerly unit is planned for the Mechanical Engineering Department, there being rooms for joint use in the middle portion. The main laboratory portion of the electrical unit has inside dimensions of 55 by 150 feet, this being connected to the front portion by a narrower "neck" which serves both to connect the laboratory portion with the office and classroom portion, and also to isolate the noises and vibrations from the laboratory. Incidentally, the neck also allows a variation in the style of architecture, making the front portion match the adjacent Main Engineering Building, while the laboratory portion is of cheaper construction.

There has been some discussion that the building does not fit in with the others of the engineering group; but such reflection is only temporary as this unit is only one side of the quadrangle called for in the Cass Gilbert plans. The rear unit, according to these plans, will be on a line with the Experimental Engineering Building and will necessitate the removal of the present printing shop. Our new laboratory stands at the head of the easterly axis of the new campus whose southerly termination is at the Elliott Hospital.

The building is of red, matt-faced brick trimmed in grey Bedford stone, the same as the rest of the engineering group. On the parapet of the south elevation, at the center of the laboratory and at the geometric head of the easterly axis mentioned above, are four angels representing "Power," "Light," "Communication" and "Transportation." They are all life size, each being 5 feet 3 inches tall and with a 9 inch base. The figures were modeled by the Brioschi-Minuti Co., of St. Paul, and were carved by Bianchi, also of St. Paul. On the panel petween the figures was to have been this inscription:

ELECTRICITY
Powerful Efficient
Convenient Adaptable
Swift Clean Tireless
Servant of Mankind



Beginning of Communication Laboratories

Consideration of space and mnemonics, however, changed the inscription to:

ELECTRICAL
ENGINEERING
LABORATORIES

In discussing the building, Prof. G. D. Shepardson said: "It has been our endeavor to construct a building with functions as nearly perfect as possible and also as beautiful as possible. To the same end we have also paid particular attention to obtaining a clean sky-line."

It is of interest to note how this has been carried out in detail in the two 90 foot radio towers, where even the aerial counterpoise is to be so close to the roof that it will be hidden by the parapet. These landmarks are not of the straight windmill type so often found, but are made with beautiful parabolic lines that are pleasing to the eye. They are what is known as an internally-braced frame, and have so wide an area at their base that no guy wires are necessary. In fact, beauty, strength, and adaptability characterize their construction. This last feature is found at the top, which was designed so that the height might be increased with minimum difficulty and expense. In fact, provisions are made for increasing the height at least 15 feet by the use of a wooden pole extending up through the present hole in the top plate. It is felt, however, that an aerial 244 feet long and 144 feet above the ground will be satisfactory for at least the first year.

The third floor of the laboratory wing will be devoted exclusively to communication work, including laboratories for research and instructional work in wire- and wire-less telegraphy and telephony, radio station and its studios. Three rooms will be given to the Signal Corps unit of the R. O. T. C., where their equipment will be set up and their instruction given. We believe this will be the best housed communication laboratory in the country with the possible exception of the Bell Telephone Company's laboratories and the government Signal Corps laboratories.

Another electrical branch about which we hear but little and know even less,—illumination engineering, will be emphasized in the new building. There will be four photometric laboratories, one above the other, the one in the basement extending down into the sub-basement. Each room, as far as practical, will have a distinct system of lighting. The illumination lecture room will have fifty-three special outlets in the ceiling, providing nine distinct schemes for lighting and making it possible to study almost any type of illumination at any time. The accomplishments along this line have been due to the work of four groups of experts who have put much time and study on the project.

The network of conduits necessary to connect the outlets in the ceiling took up so much of the joist area and decreased the effective depth to such an extent that the ceiling had to be specially designed. In figuring effective depth the distance to the bottom of the reinforcing is always taken in preference to the distance to the bottom of the concrete. Hence for this ceiling it was necessary to increase the amount and the depth of the reinforcing. This was only one of the many problems in concrete construction that had to be met.

In order that set-ups may be made in any part of the building without exposing the wiring, Prof. Springer devised a scheme of wire shafts, raceways, channels, panels and wire trenches, both lateral and vertical. These different forms of conduit do away with the mass of wiring usually found on the ceilings of laboratories. By the new plan all of the wires are concealed from view, are protected, and yet are easily accessible.

There are seven vertical wire shafts, of which the one behind the switchboard and beside the elevator shaft is the most important, connecting with the tangle room and switchboard, and having branches leading out on each floor. There are two similar, though much smaller, shafts in the connecting link and four in the head of the building. Each extends from the sub-basement floor to the roof slab, and has door openings on each floor.

Two main raceways extending nearly the full length of the basement ceiling serve as supply lines for the lateral channels below the first floor of the laboratory and also for rooms in the connecting link. These raceways are hung from the ceiling and are about 26 inches wide by 16 inches deep.

Along the outside walls of the laboratory on each floor are fixed benches with composition top. Under each bench is what is known as a "wall trench," 1 foot wide and 6 inches deep. By connecting to the wires in this trench any circuit may be made with only a few feet of wire. But as all experiments cannot be conducted on the wall benches, many

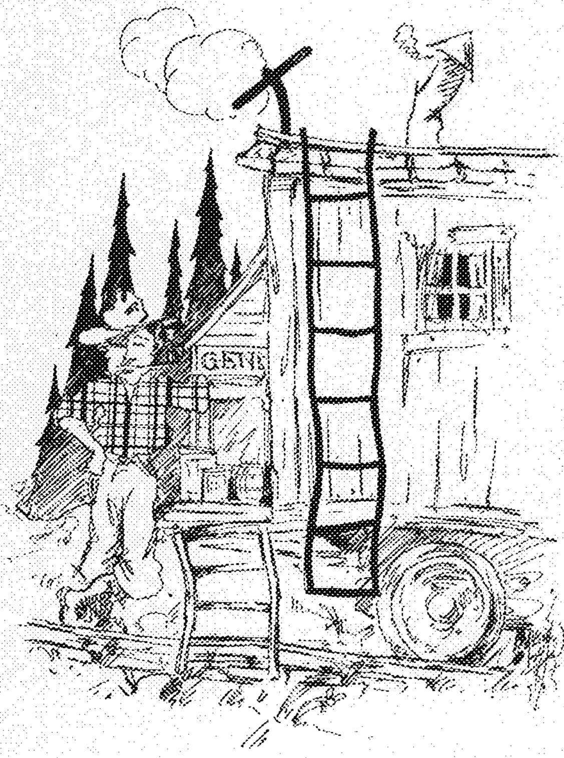
(Continued on page 28)

BUILDING CONCRETE WATER TANKS

In Which the Field Difficulties are Revealed With A Slight Accent on "Tanks"

By A. B. Greene, E. E. '24

THEY say that a doctor can bury his mistakes, and that a dentist must have a pull, but it is the engineer that rears in every work he builds a lasting monument to his craft and his integrity, the defects of which cannot be hidden. Especially true is this when ideas are new and every inspecting eye is critical. The stateliness of the finished work shows little of the skill and science that wove itself into the construction processes and is hidden within the silent exteriors. Ask the red-blooded builder of today whether the joy of his task lies in the beauty of his product, in the compensation he receives, or in his mastery over matter and his triumphs over the elements and circumstances that seek to thwart his projects.



"Our Pullman"

Water has been with us for a long time, and man has put it to many uses. He has traveled over it, on it, and in it. He has harnessed it, played with it, admired it, and in some cases drunk it. Considering the abundance of the supply it would seem that to store it would be unnecessary, but man has spent much of his time doing just that. He has kept it in many places, from the ornamental fish-bowl on the parlor mantel to the deep recesses between mountain walls; and from the vast assortment of names and places, shapes and sizes, and other distinguishing features that mark the trend of science and the variety of man's needs, I have chosen for enlargement but a single type—the humble railway water tank.

Although the primary use of a railway water tank is to provide water for thirsty locomotives, it has served for many other purposes—from the rendezvous of shabby pedestrians to an excuse for naming an otherwise indistinguishable spot in the geography. The latter is the case at Robinson, so named for short because of the historical suggestiveness of its isolation. There are three buildings of what one might call prominence—the roadside store, the section house, and the station, important in the order named. The station is the building that they have the name of the town hung on. Aside from that it hasn't any particular function except as a sort of a marker to guide the trains in the matter of slowing up. The station itself is a splendid structure of wood, artistic for its simplicity. It is located near the tracks and has a large platform, twenty feet long and four feet wide, running past both sides of the front. Here the trains slow down in the morning to let the people off and again in the evening to pick them up again. The freight agent, train dispatcher, telegraph operator, ticket agent, general information bureau, and a third of the town's regular population, has his desk just inside the window. The only reason he isn't the mail man, too, is because there isn't any mail. In front is a regular, full-sized, painted signal tower with a ladder up the front, on which the children of the section workers are given an advanced education so that they can eventually go down to Duluth and get jobs as firemen. Out in back is about a thousand miles, more or less, of unidentified scenery.

Probably a little ought to be said about this unidentified scenery, because it not only happens to contain the geography of our story, but deserves recognition as part of, or at least the entrance to, the great playground of the Northwest and the Canadian wilderness. We were in the heart of the Vermillion Range, so called, I presume, because of the redness of the iron that stimulated man's interest in its existence. Not a mean share of Minnesota's ten thousand lakes were scattered around us. (My heart goes out with utmost sympathy to the well-meaning man that made passage in order to count them all.) The lakes seemed to nestle in mute mockery to the vast wastes of second growth that vainly tried to hide the scars of great forest fires. As one stood on a hill and tried to find the horizon his vision was lost in the maze of tall black sentinels, the silent rebuke to some careless camper's match. The brush and young pines made passage impossible except where deer had worn a path; the surfaces of the lakes were cut only by the progress of a beaver or ripples following the flight of some long, shiny pike. Of course if we wanted to go into detail about the mesh that nature can weave around a man's ambition we would soon have our gun in hand and be pushing our canoe away into the quiet fastnesses that men in busy cities dream about. But since we were there to make a water tank, ours was only to cast longing looks at the hills, but meanwhile keep our hands at tasks more concrete in nature.

Have you, gentle reader (I think Dickens uses that expression), ever reveled in the diversities of a railroad chow car? If you have, it is unnecessary to remark further; if you have not, far be it from me to rob you of the chance. Our cook could not speak English, although I feel sure that she understood many of the sounds made by the food in the process of consumption. She was Finnish, and so was the menu, and I could never quite be sure but that one of the N's should have been left out. I wouldn't have you think for a minute that we lacked food, either in quantity or variety, for I worked ten to fourteen hours a day myself and gained ten pounds during the summer; but I will say that the caviar was a little under-done at times, and the servants were terribly careless about the linen.

Our Pullman reposed just to leeward of the dining car. It was a homelike place, containing many of the original ideas of Mr. Pullman during the formative period of his inventive career. The discomforts, such as existed, were inanimate, and the bedding was clean and plentiful. The car differed from regular freight cars in that the doors were at the ends instead of in the side of the car. By each bunk was a little square window, destined to ventilate but very effective as a weather forecaster. If it rained in your face it indicated stormy weather, while the fluttering of blankets and the congealing of the blood foretold "cooler, with a slight wind." Everywhere were screens, and everywhere else were mosquitoes. If they couldn't get through the screens they would bring their young up to the window, kiss them goodby, give them final instructions and push them through the screen to grow up inside; and they had every reason to thrive. But all this was part of the game, and no one cared much.

However, we had not come north for the purpose of studying rural economics, sociology, or etymology. Our business was Concrete Water Tanks, and we were not to blame for the eccentricities of the scenic background. Even so, many people forget that an engineer lives while he works, and that the things around him are a part of his life for the time being. So our kitten-ball games, our horseshoes, the fireside ballads, and the icy plunges in the waters of the lake, although not included in the specifications, were indeed very much a part of the water tank.

It would be folly to try to trace in this short space a chronological outline of our method of procedure, such matters being the property of the contractor and contingent to his equipment. There were, however, some little incidents that an engineering job begets that added a little zest to the undertaking.

The first week ended without much that worried, but lest we went stale on the job one of our individuals took the liberty of walking into an oncoming ore train, in utter disregard of its thirty m.p.h. velocity, and its several thousand tons of ore. Being none other than a student at our own institution (not the writer), and therefore necessary to the success of the enterprise, fate spared him, and after knocking over a barrel of water and traversing fifty feet or so in rather unconventional manner the gentleman picked himself up with only a bruised shoulder to mar the serenity of his feelings. Of course he served our cause by saving us from a similar fate through his timely warning.

Our first real disaster occurred just as we were starting the pouring of the bowl proper. The part of the tank that contains the water must be poured in one piece, so that there will be no joints to leak, and elaborate preparations were made to have equipment and materials available for an uninterrupted run from start to finish. About the third bucketful, however, fate stepped in, loosened the cable clip on the hoisting bucket, and dropped half a yard of mud fifty feet to the bottom of the tower. The bucket mushroomed like a paper sack and the tower spread its legs accordingly. It meant sending to Minneapolis for another bucket, extracting the remains of the old one, the repairing of the tower base, and the removal of the concrete already poured from the bottom of the fourteen-foot forms. The last task was the toughest, the forms being only a foot between and filled with reinforcing tied in place. Because of the nature of the forms, however, we were able to remove some of the lower sections without disturbing those above, and at the end of the day we had removed the offending concrete, scraped the joint clean, and polished all the reinforcing. The bucket came by express and again we set the stage for a record run of fifty continuous yards.

Our progress lasted half a day without incident. The water was seeping out from cracks well up to the halfway mark, and everything was moving smoothly. Suddenly disaster descended upon us with a crash. The hardworking steam engine on the mixer weakened under the strain and passed out. First the guide plates, then the connecting rod bearings, then the connecting rod. And not content with that, the momentum of the mixer continued to rotate the parts until the piston rod was broken and the pieces well chewed up. Of course no repairs for so extensive a damage could be secured. Welding was out of the question, and the concrete in the forms was slowly beginning to set on the surface. Hand mixing crews were immediately organized while we made a hurried survey for mixers. Our search ended in Tower, whence we towed home a dainty little hand-dumping, revolving barrel, common to the making of cellar floors or sidewalks. It was everything there was, so we went at the job again. We had filled the first half of the tank in four hours—the last half took fifteen, and when time was called and the forms were full we were a sorry-looking, half-dressed crew—and not a man but what was singing.

Not much has been said thus far in this article concerning the nature of the tank itself. Concrete tanks are not a new venture, but there are so many elements that combine to wreck a concrete structure that the problem had never been successfully adapted to water tanks. The style we built probably represents the nearest that present day designers can come to a successful concrete tank. It was designed and built by the Standard Concrete Tank Company, of Minneapolis, who hold all the patents. The main feature of its appearance is its cylindrical construction, embracing an engine or pumping room in the lower part, and the water tub in the upper part. In the case of the Robinson tank there was a sub-section built below water level and connected to the lake by gravity flow to feed the pumps. The entire structure is a solid piece of concrete, re-inforced with steel. The walls are a foot thick in both the lower and upper parts. The inside diameter is twenty-six feet. In order to hold, unsupported in the middle, the enormous weight of the 100,000 gallons of water above it, the tub floor must be two feet thick, and particularly re-enforced so as to take the many different strains that come upon it.

(Continued on page 28)

THE APPRAISAL AND ENGINEERING

Industrial Valuation Field is Open to Engineers--- Co-Insurance Clause Is Explained

By Merton A. Pocock, Consulting Engineer
General Manager, Engineering Appraisal Company

WHAT have science and engineering to do with the valuation of physical assets of a manufacturing plant?

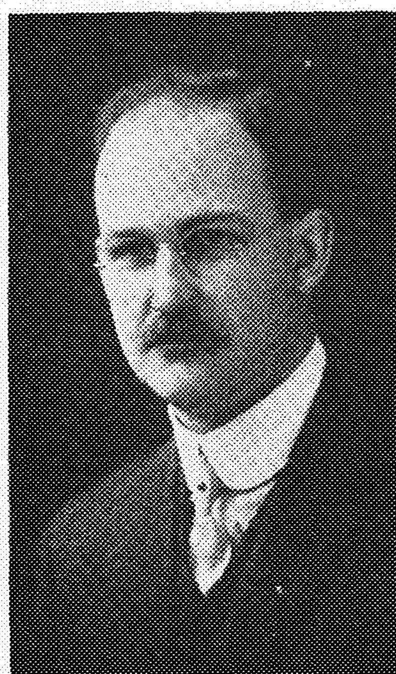
It is only within the last few years that any real achievement has been recorded in the effort to put industrial appraisal practice upon a sound engineering foundation.

The problem of physical valuation is one that can only be solved in its entirety by the application of fundamental principles of engineering and economics. Accurate sound values of such property are determined only by the adjustment of the factors concerning the actual condition of such property and its relation to the world of business.

The function of the engineering valuation, the complete appraisal of the property, may be summarized as follows:

- For permanent inventory.
- For correct placing and adjustment of insurance.
- For reorganization and capitalization.
- In the event of sale or purchase.
- For financing.
- Tax adjustment.
- Depreciation and depreciation reserve fund.

Many firms now regard their appraisal to be as great a necessity as the regular audit of their books. No public accountant, insurance company or banker will hesitate to endorse the principle of physical valuation. The appraisement and classification of physical property is a profession in itself, demanding expert knowledge, and long training.



Mr. M. A. Pocock

Many business managers, even some who are credited with keen insight into the operations of their business, will attempt a so-called appraisal of their own property. As to the manager's appraisal, can it be possible for him to set up a report that would be given serious thought by outsiders? The advantage of an unbiased appraisal by a neutral outsider can hardly be exaggerated.

An appraisal report for most purposes consists of a volume, classifying and listing physical property, a summary of the separate findings and a certificate of values. The summary should set forth in terms easily understood and readily located, the cost of Reproduction New and the Sound Value, the details following in proper order, displaying "piece bill" of structures, listings of machinery, and all other classifications properly depreciated.

New Reproduction Cost is the real basis upon which the appraiser works: the starting point for depreciation after "piece billing" and inventorying the entire property. More accurate results are obtained, for it is universal in its adaptability. It involves the hypothetical reconstruction, piece by piece, of the property under consideration; each unit of construction, each item of equipment, is computed at what it would reasonably cost to reproduce new at the time of the appraisal, using the existing normal prices of materials, labor, and equipment, giving consideration to purchasing power of the client and freight rates both car load and less car load. New Reproduction Cost and Reproduction Cost must not be confused, as it is quite practical to ascertain New Reproduction Costs whereas to reproduce a plant in its present physical condition is an entirely different problem.

Sound Value is the next and most important figure we desire; in fact, the object of our work. It is that value, ascertained after deductions for depreciation have been taken. Depreciation being governed by condition, age, obsolescence, and inadequacy.

Insurable Value follows and is the Sound Value less those portions of the property commonly called Uninsurable, such as the excavations, sewer, underground steam and water lines. This figure is necessary for the proper placing of insurance. The insurance engineer looks for this figure without care or thought as to other values. He is one of the many men who will study the appraisal volume item for item, raising objections as to "costs," installation estimates and depreciation in detail.

Division by Classification is made so that we may more readily follow certain lines of procedure; it permits of ease and certainty in handling; oversight is reduced to a minimum in searching out units of one class; an appraiser often finds other items out of their proper or expected location. These same classifications are also quite familiar to the accountant and can be adopted by him in the event of setting up the appraised values on the books.

Possibly the greatest use of the appraisal is in the determining of sound insurable values. The owner of an appraisal cannot only furnish proof of loss in the event of destruction of his property, but can also avoid the pitfalls of co-insurance. There are only a few business men and engineers who are accurately posted on the meaning of that word. Co-insurance is a form of partnership in the insurance business, the purchaser of such entering into an agreement with the insurance company whereby he agrees to carry a certain portion of the insurance himself. The insurance company in return quotes a lower rate, thus giving a direct saving to the assured. But, deceptive protection only is provided by co-insurance unless accurately placed. If a property is covered by an 80 per cent clause, it is protected for no greater proportion of any loss than the amount insured bears to 80 per cent of the insurable value computed when such loss shall happen.

Suppose that in placing the insurance an insurable value of $200,000.00 was assumed. A policy bearing an 80 per cent clause is written for $160,000.00.

A fire occurs.

The adjuster checks up the replacement value and deducts depreciation. Suppose he establishes $250,000.00 as the sound insurable value at the time of the fire.

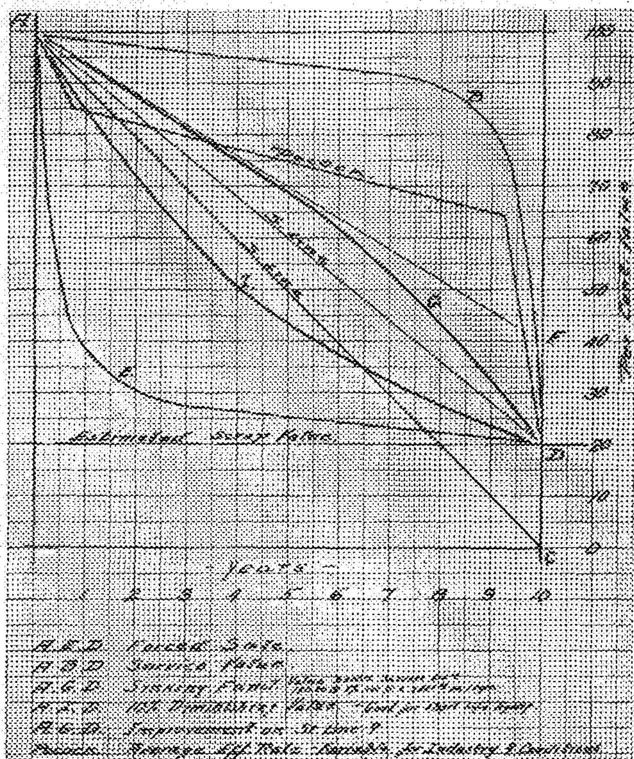


Fig. No. 1

$160,000.00 is only 64 per cent of $250,000.00. The insured portion is 64/80ths. On any partial loss the assured is a co-insurer for 16/80ths.

If the loss was $80,000.00 the payment will be $64,000.00 and the assured will bear the $16,000.00.

This shrinkage of protection was caused by the inaccuracy of the insurable value assumed originally. Appraisal service, determining a true insurable value in advance, would have saved $16,000.00 in the above case.

Appraisal service becomes a super-insurance which guards against such shrinkage of protection. Without an appraisal co-insurance is deceptive.

Depreciation from the insurance standpoint is "a fair deduction for service based on condition at time of fire." It is therefore obvious that no "age rate" or theoretical rate in accounting will give the worth of the physical assets.

Book values, in the event of loss by fire, might force the insured to accept settlement on that basis or force him to submit evidence to prove that the books did not represent the true value—a difficult thing to do; memory as an aid at this time makes for a poor settlement. The one answer is to have a disinterested appraisal while the property is still whole.

It is not only a question of the amount of money you are able to collect after a fire, but the promptness with which it can be effected, thus preventing great losses of time and profits, either of which may offset the cost of an appraisal many times over.

In cases of consolidation, appraisal forms the one and only fair basis to trade plant dollars. Recognition by auditors, bankers and the buying public is without question in these cases. Bond issues are now based upon appraisals, most bond houses having their preference as to the firm of appraisers.

Again, depreciation interests the banker. Fair appraisal practice has often caused the client to tell the appraisers that they are low, or away off, but in every case where the first reaction has been of this type the clients have approved the findings and to my knowledge became boosters for the appraisal.

Depreciation is "the lessening in value or worth of a thing." When one says an electric bulb, a 50-watt electric bulb, we seemingly know what is meant; the fact is that if we were sent out to get one we would come back with the article; but if we are told to take a look at machine tool number fifteen and tell what depreciation to figure, how many of us would have the same answer?

Again take concrete buildings for example, which Uncle Sam says, are good for one hundred (100) years; thus the accountant says, "How old is building one—eight years—that's easy, 8 per cent depreciation." But a frame building is a bit different. Thirty, forty or fifty years may be the probable useful life, yet the New England states have quite a large number of old colonial residences doing duty as such over a hundred years since construction; there are old mills and factories still doing duty long after their theoretical death date has passed. Therefore, if frame buildings will stand for this period of time is it not practical to estimate that concrete buildings will last much longer than one hundred years? True, it is not good practice to go very far beyond the possible life of man, but as an appraiser one must set a value thereon.

Depreciation is not simple; it is a complex problem. However, the difficulty of computing it does not warrant haphazard methods nor the entire abandonment of it.

Business men should not place so much reliance on the rule-of-thumb rates such as 2 per cent or 3 per cent for buildings, 5 per cent or 10 per cent for machinery, 20 per cent for trucks, etc.

Depreciation is not an exact science, nor will it ever be. The efforts of engineers working together is beyond question providing material of great value, yet the best judgment would only be an approximation often changed by subsequent experience.

A guess cannot be justified. An estimate can, for it takes into consideration all factors that may govern a given situation. One must weigh each factor and assign the proper importance to them, relying of course upon past experience as well as personal inspection of the property.

Chart 1 shows the different methods of computing depreciation. I have assumed that 20 per cent of the original value can be recovered by a scrap sale of the property. If no account is taken of the scrap value the depreciation on a ten year estimated life basis would be 10 per cent a year for the period as shown by line AC. This method is known as straight line depreciation. If the scrap value is assumed the annual depreciation taken is less than 10 per cent a year and is denoted by AD. If instead of a definite set yearly percentage we take into account the interest the depreciation fund will accumulate and amortize the allowance we have the curve AGD. This method is an improvement on the straight line method in that it follows in some measure the service value curve ABD, which diminishes slowly at first due to the excellent condition of the property, and more rapidly toward the end of its life when the factors of inadequacy and obsolescence begin to influence the value. The antithesis of the service value curve is the forced sale value which is based upon the well known fact that an article is second hand the minute it is put in use. The diminishing value curve AID is often used for short lived equipment. It is merely the amortization or sinking fund curve reversed so that the heaviest depreciation is taken at the beginning of the life instead of the end. This curve finds its advocates among those who favor the forced sale value.

Based upon the study of theoretical depreciation from all its angles and actual experience in the determination of depreciation from physical condition there has been evolved the Average Efficient Value curve. This curve will under given conditions represent the usable value of capital assets of a manufacturing plant or business enterprise. You will notice that it drops rapidly during the first few months of operation and then dropping gradually for the majority of the life until approximately 65 per cent average efficient value is reached. When the average of an organization as a whole is below this point, as shown in an Engineering Appraisal report, it is advisable to recommend either the abandonment of the same or the institution of repairs necessary to increase its value.

Chart 2 shows in *exaggerated* form the effect on the average curve when repairs are made to the property. This will increase both the average efficient value and the life of the property.

We must differentiate between groups of assets and again between the parts composing such groups thus classifying, for the proper recording of depreciation. In our work we have built up certain data covering different industries which are used only as a basic guide to the general factors of the industry under consideration.

In connection with the recent \$3,000,000.00 consolidation of certain companies it is interesting to note that many units were depreciated as great as 50 per cent and some to 75 per cent or 80 per cent of their Cost of Reproduction New, yet the average efficient value of these properties ranked as follows: 76 per cent, 73.6 per cent, 70.3 per cent and 69.5 per cent.

In the last analysis another factor was brought into consideration, "suitability," and the decision was then made to close entirely one plant worth practically half a million dollars.

It should be recognized that the experience of any one firm is limited, that it should be supplemented by the experience of the industry which brings to bear obsolescence. Machinery of a special nature or applicable only to a certain industry is subject to greater obsolescence than equipment of a more or less standard nature.

In plain words, depreciation means an opinion, based on specific conditions, which influence deterioration, such as age, obsolescence, climate, exposure, use, maintenance, and estimated utility life.

Regarding the life of an article there are two classes—"Natural," subject to the aforementioned causes, and "Functional," subject to inadequacy and suitability.

A copper transmission wire may last for hundreds of years, who knows, but the demand for power on the line in question may and does often call for its replacement within comparatively few years.

In this modern age it is quite possible to develop improvements within such short spaces of time that a wise management will not only give consideration to this from the beginning but will be willing to secure service outside of their organization to keep track of such changes.

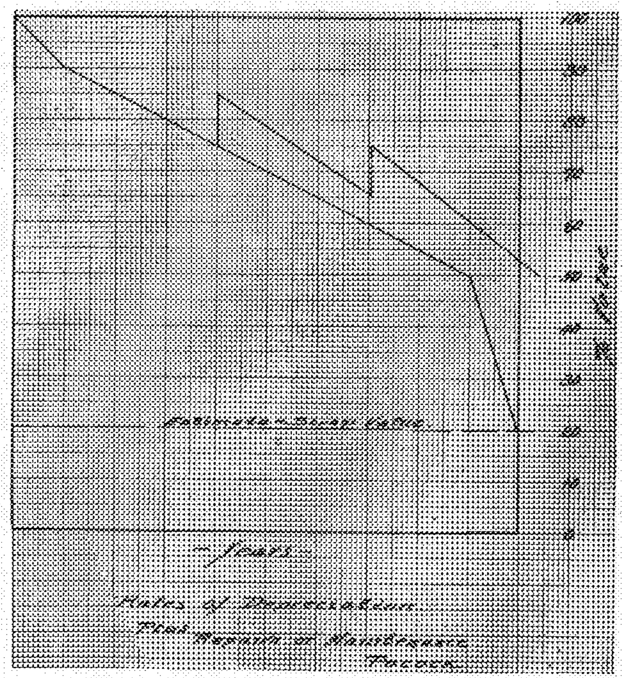


Fig. No. 2

From the foregoing it seems true that men who are trained appraisers are by far better fitted to judge depreciation than men who only attempt such problems once now and then, thus placing this work purely in the field of the engineer.

Then looking at investment from a good business standpoint, does it seem proper to say a profit has been earned when little or no provision has been made (based on sound engineering) for depreciation and renewals?

Appraisals are now being used for determining departmental distribution of burden; to correct investment records; to determine normal costs in comparison with the actual costs; selling prices; settlements of estates; partnership arrangements or dissolutions; depreciation reserves, and for harmonizing federal tax returns.

A large field is before us in the annually establishing of depreciation rates from appraisal figures, by inspection only. We are now serving clients in this manner instead of the so-called continuous appraisal service, often carried out by the process of addition and deduction to the original work without inspection.

Service not coupled with inspection is unethical and dangerous. A client may for example send in a service report showing the addition of certain equipment, the deduction of other units. Continuous or monthly service by the appraisal company calls for maintaining plant values; therefore, in the event of fire loss it would be possible for an unscrupulous client to doctor these reports and present the appraisal companies' certificate as evidence that the

(Continued on page 29)

THE TECHNICAL ASSOCIATION

Last year at a special election held in the spring quarter of the year, the constitution of the Technical Association was adopted. Previous to this time the student body was being governed and was expressing itself through such organizations as A. E. S. and the Student Council. These organizations though representative of the voice of the students miserably failed to function. The need of a new organization was apparent. After a careful survey of existing conditions, the Technical Association was formulated by the active heads of the various organizations in co-operation with the faculty. As the new association has been functioning since the beginning of the school year, it is important that the student in engineering should become familiar with its constitution.

CONSTITUTION OF THE TECHNICAL ASSOCIATION OF THE UNIVERSITY OF MINNESOTA

ARTICLE I.
Name.

Section 1.—The name of this organization shall be the Technical Association of the University of Minnesota.

ARTICLE II.
Purpose.

Section 1.—The purpose of this association shall be to provide a federation of departmental societies in the College of Engineering and Architecture and the School of Chemistry, and to enable the students of the various departments to act as a unit in all matters of general interest to these Colleges and to the University.

ARTICLE III.
Membership.

Section 1.—All members of the recognized professional departmental societies of the College of Engineering and Architecture and the School of Chemistry shall be active members of the Technical Association.

ARTICLE IV.
Government.

Section 1.—The executive body of the Technical Association shall be the Technical Commission, composed of the presidents of the recognized departmental societies and two faculty members who shall be appointed by the dean from the College of Engineering and Architecture and the School of Chemistry. This body shall hold office for one year. The original recognized societies are:

1. The Architectural Society.
2. The Chemists' Club.
3. American Society of Civil Engineers.
4. American Institute of Electrical Engineers.
5. American Society of Mechanical Engineers.

Other departmental societies may be added with the unanimous approval of the Commission.

Section 2. The Technical Commission shall exercise its power through the component societies. The commissioners shall have authority to act for their societies and their actions shall be binding on every member.

Section 3.—The duties of the Technical Commission shall be:

1. To select from among its members a chairman and secretary-treasurer at a meeting to be held not later than two weeks previous to the June Commencement.
2. To foster student enterprises until such time as they are in a position to operate independently.
3. To supervise Engineers' Day and elect a chairman and committee to conduct the activities.
4. To call at any time, for any purpose that it deems fit, a meeting of any or all members of the Technical Association.
5. To collaborate with the All-University Council for the welfare of the University.
6. To act on matters of general interest to all members of the association.

ARTICLE V.
Student Councils.

Section 1.—The Chemistry Student Council shall be organized by the School of Chemistry and shall be independent of this association.

Section 2.—The Engineering Student Council shall be a committee of the Technical Commission, with final authority for its actions within the limits herein defined, and shall consist of the following five members:

(1) The president of the American Institute of Electrical Engineers; (2) the president of the American Society of Mechanical Engineers; (3) the president of the American Society of Civil Engineers; (4. the president of the Architectural Society; and (5) the representative of the College of Engineering and Architecture on the All-University Student Council, who shall be the chairman.

Its duties shall be:

1. To conduct all student elections held in the College of Engineering and Architecture, the expense of such elections to be assessed pro rata against the member societies in that College and collected by the Commission.
2. To regulate matters of student discipline.

ARTICLE VI.
Finance.

Section 1.—The finances of the Association shall be contributed by the departmental societies on a basis proportionate to their memberships and shall be collected from the societies and not from the individual students. Engineers' Day shall be operated so as to provide funds for the Association. The funds shall be disbursed only for Association purposes on the basis of a definite budget, prepared by the retiring Commission.

Section 2.—The fiscal year of the Technical Association shall end on May 15th of each year. The accounts shall be audited and report submitted not later than May 20th. The financial report of the Commission shall be published in the Techno-log in the fall.

ARTICLE VII.
Status.

Section 1.—The Association shall be a local chapter of the Association of Collegiate Engineers. The Association shall send and assume the expense of two delegates to the national convention of that body. The delegates shall be the chairman of Engineers' Day for the current year and the year immediately preceding.

ARTICLE VIII.
Amendments.

Section 1.—The constitution and by-laws may be amended only with the approval of all of the departmental member societies.

ARTICLE IX.
Procedure.

Section 1.—The deliberation of the Commission shall be governed by Robert's Rules of Order.

(Continued on page 32)

ENCIRCLED WITH 110,000 VOLTS

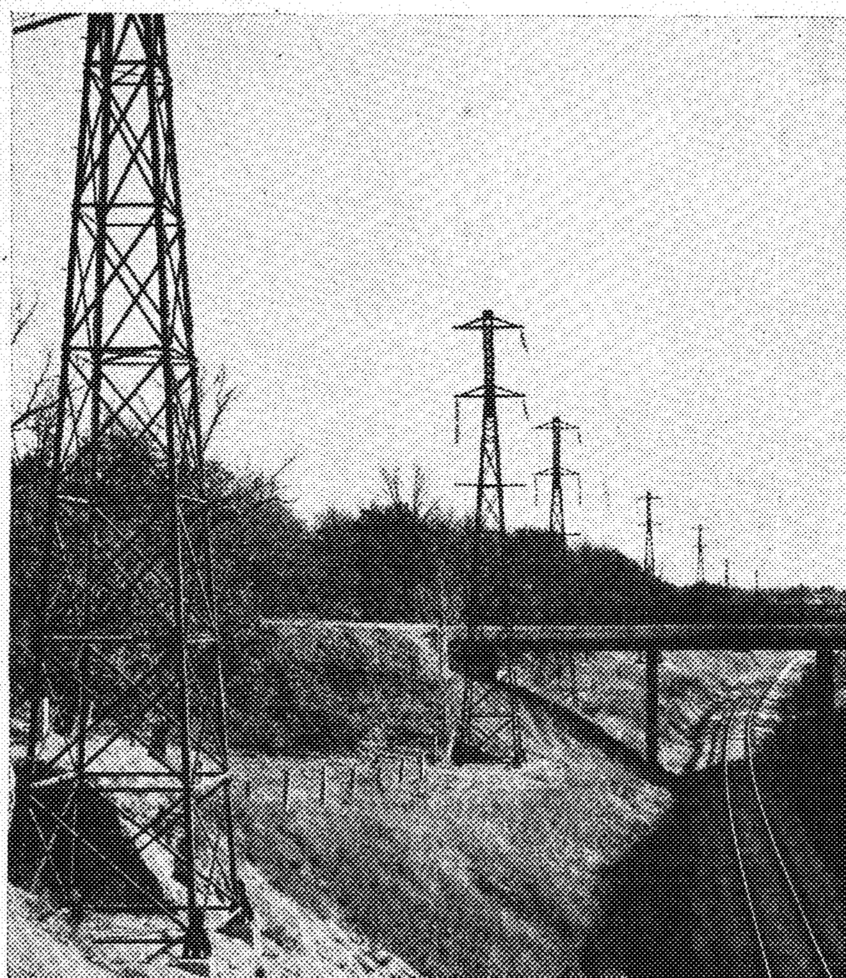
High Tension Loop Will Form Part of the Northern States Power Company System

By Albert W. Morse, E. E. '25

THERE is now under construction around the Twin Cities a high-tension loop, designed to carry 110,000 volts, which will form part of the system of the Northern States Power Company.

At the present time, practically two-thirds of the line is up, leaving about fifteen and a half miles yet to be built. From the Rogers Lake sub-station, southwest of St. Paul, the line extends east to the Stock Yards station, north to the Oak Park line, which comes in to the Twin Cities from the east, west to the Terminal station, further west to the Riverside station, then south to the new Aldrich station. It is planned to build the remaining stretch between the Aldrich and Rogers Lake stations out of the company's 1924 budget.

The newest portion of the completed line, that from Riverside to Aldrich, was constructed last summer by the Byllesby Engineering and Management corporation, operating from its Chicago office. Towers, especially designed for this line by the Chicago office, are used for four miles out of Aldrich.



A Portion of the Completed Line

After the line was surveyed and the pole locations marked by the advance crews, sometime in May, operations began simultaneously all along the line from Riverside to Aldrich. Erection of the wooden poles, which are used from Riverside down to 32nd Ave. No., did not require very much time, and the workmen concentrated upon the towers; the wire crews followed directly behind those engaged in tower erection. The construction was completed about the first of November.

The towers are of steel construction, self-supporting, and set in concrete at depths ranging from nine to twelve feet. In the swamps near Aldrich, it was necessary to use piles. The water here was about four feet deep, and delayed the work of cribbing and pouring concrete about a week.

It was necessary at railroad crossings to maintain a clearance of about twenty-six feet above rails. So in cases where the track was on an embankment, exceptionally high towers had to be designed. Navigable stream necessitated special towers, also.

On the entire line about the cities, the various tower heights are 51, 61, 65, 72, 74, 88, 95, and 110 feet. And the bases range from 16x16 feet, for the 51-footers, to 30x30, for those 110 feet high. The Riverside - Aldrich line has towers 51, 65, 80, 72, and 88 feet in height.

Towers are spaced about twenty to the mile, depending, of course, upon the terrain. Ten feet is the standard distance between insulators on this line, which allows for high winds and other conditions tending to bring the wires together. On the curves, the insulators are tied town to prevent swinging. The steel of the super-structures is fastened to the concrete bases by anchor bolts. At crossings, corners, and other points where the wires may break, "dead-ends" are employed. That is, the wires are broken and fastened separately, and then "tied around" the break. The wire used throughout is 4/0, strand, copper, B and S gauge.

In determining the type of insulators to be used, exhaustive tests were made upon several brands, resulting in the use of those made by the Lapp company. It was found that these had an average, ultimate, tensile strength of 18,000 pounds, whereas the nearest mark reached by others was 8,000 pounds.

The Lapp insulator is made of porcelain, which

(Continued on page [illegible])

ALUMNI NEWS

In the hope that we can locate a number of "lost" engineers, we will publish a list of names in each issue of the Techno-Log. These are names of men who have changed their mail address and of whom we have no location record. The Techno-Log and the dean's office are desirous of keeping a complete and up-to-date record of our alumni. If you have any knowledge concerning these men you are urged to send it to the alumni editor of the Techno-Log.

Civil Engineers
Cyril D. Jensen
Geo. W. Jevne
C. R. D. Jorgens
Jasper F. Keeler
Enghet A. Lee
Harry J. McCall
Claude L. McClelland
Frederick T. Paul
William G. Peters
Clarence M. Rader
Orison B. Robbins
West A. Rolfe
Martinian G. Smolensky
Clarence H. Stewart
Oliver A. Stoutland
Festus P. Tierney
Cedric S. Weatherill
Robert W. West
Arden D. White

Electrical Engineers
Eugene H. Adler
Frank A. Anderson
George W. Bleecher
Alfred Brachrack
William G. Briggs
Louis M. Brown
Harvey L. Burns
Fred R. Burt
James W. Casberg
Wm. H. Dewey
George R. Duncan

CIVILS

L. S. Mitchell, C. E. '23, insists on giving us his home address, 3452 Pillsbury Avenue, Minneapolis, Minn. We are taking steps to find just where "Mike" can be found. He is working as construction foreman for Ward & Weighton. Ward is the father of John Ward, Jr., who is trying his luck here at school, but that is nothing against the firm, "Mike" says. "Mike" is an "M" man, Phi Kappa Sigma, and Plumb Bob. Not so good looking, but fine for work.

Earl H. Grochau, C. E. '21, is living at 24 South Front Street, Memphis, Tenn. The cold weather must have driven Earl to Tennessee, because we note that he took the position of cost engineer with the Gauger-Korsmo Construction Company in March, 1923. Before this time he worked as estimator and instrument man for the Minnesota State Highway Department. Listing his activities while at school we have: Sigma Phi Epsilon, A. A. E., Gopher staff, and R. O. T. C., 1st Lt. Comm.

Regarding the flexibility of an engineering education we mention **Lawrence W. King,** C. E. '09. He is manager of the special risk department of the St. Paul Fire and Marine Insurance Company, where he has been since 1918. The King family, composed of Lawrence, his wife (Josephine Ware), Ware Garbett, age 7 years, and Nancy Middleton, age 9, is living at 1829 Lincoln Avenue, St. Paul. The children are attending Ramsey public school.

Now here we have news of **Kenneth Klassy,** who spent two years at Minnesota and graduated from Harvard with a B. S. degree in Civil Engineering in '22. He spent the holidays with his folks at 1970 Penn Ave. So., Minneapolis. Kenneth is employed as resident engineer on construction for the Illinois Highway Department, with headquarters at Dixon, Illinois.

Speaking of Dixon, Ill., that is the place where we will find **"Bye" Curry,** C. E. '23, after January 1, 1924. He is still in the employ of the Sandusky Cement Company. The "Admiral" checked in for the holidays and together with "Mike" Mitchell we had a bit of a reunion. "Mike" is to go into the office of Ward & Weighton when he returns from his vacation. His last detail was in the state reformatory in Nebraska—not as an inmate, however. The company was constructing a sewage disposal plant and "Mike" was there to see that the work was properly handled.

L. J. Sverdrup, C. E. '21. Effective January 1, 1924, Mr. Sverdrup is promoted to chief bridge engineer, Missouri State Highway Commision. Missouri, at the present time, has the third largest highway program of any State in the Union, and has the largest bridge program of any State. Four bridges are at the present time being built over the Missouri River, the contract price for the smallest one being $650,000 and for the largest one $1,246,000. Address, Jefferson City, Mo. It is evident that all of Mr. Sverdrup's jumping is not done on skis. He is secretary of the National Ski Association. Sverdrup is in Minneapolis arranging for the Olympic ski tryouts.

Gilbert C. Staehle, C. E. '20, is a consulting engineer in Minneapolis. In the employ of Mr. Staehle is A. C. Larson, also of the class of 1920.

At a joint meeting of the Twin City and University chapters of the A. A. E. on December 7, 1923, a letter from **Glen Nelson,** C. E. '23, was read to the members. He requests his membership be changed to the chapter at Long Beach, Calif. Glen is working there for an engineer. He is doing subdivision work and is very well pleased with it.

John Schlenk, C. E. '23, is with the Phoenix Utility Company of Duluth, Minn.

George W. Putnam, General Engineering '18, is living at 1019 West High Street, Jefferson City, Mo. On May 1, 1922, he became state sanitary engineer and director, in the division of sanitary engineering of the Missouri state board of health. Before this time he was employed by the Refinite Company as their district manager in Minneapolis. On January 2, 1920, Mr. Putnam and Mildred C. Jones, of Williamsport, Pa., were married at Mrs. Putnam's home, and now the family boasts of George W., Jr., and Jean C., ages 2½ years and 5 months, respectively.

B. J. Peterson, C. E. '12-'13, is living at 1277 New Hampshire Ave. N. W., Washington, D. C. Barney is working for the United States Geological Survey in Washington.

E. J. Erickson, C. E. '22, is a designing engineer in the bridge department of the Soo Line Ry.

J. F. Keller, C. E. '22, is employed by the Great Northern Ry. in their bridge department. The class of '22 must have a tendency to go into bridge work.

ELECTRICALS

E. S. Bjonerud, E. E. '22, made a flying trip to the University in October. He has recently completed the test course at the Schenectady and Pittsfield works of the General Electric Company. Earl is on his way to San Francisco, where he will be one of the commercial representatives of the company.

George J. Schattler, E. E. '23, has been assistant examiner in the United States Patent Office since August 1, 1923. He gives his address as Room 315, Patent Office, Washington, D. C. George is another engineer who sees a possibility in engineering law. He is studying law at George Washington University night school. These engineers get so accustomed to studying that they can't stop when they finish the engineering course at Minnesota.

A. B. King, E. E. '08, is with the Electric Machinery Manufacturing Company of Minneapolis as their eastern sales manager, with offices at 52 Vanderbilt Avenue, New York. Like most New Yorkers, he lives in New Jersey, at White Plains.

Arch Robison, E. E. '09, who is still with the J. G. White Engineering Corporation, is engaged in oil refinery construction at Parco, near Rawlins, Wyo., having removed to Wyoming last March from West Virginia, where he was engaged in power plant construction for the same firm.

Arthur P. Peterson, E. E. '19, is living at room 602, 15 West 37th St., New York City. He is field representative for the Association of Electragists, with whom he has been connected since February 1, 1923. He made many friends in his position as instructor of drawing in the College of Engineering at the University of Minnesota, which position he gave up to assume his present one. Mr. Peterson was very active while at school, being a member of the following organizations: T. K. E., Shakopean Literary Society, Board of Publishers (president), and the University Senate. Mrs. Peterson was Julia Harrison, S. L. A. '18.

Better late than never we announce the marriage of **Ed. C. Sickel**, E. E. '23, and Esther S. Thysell on September 22, 1923, in St. Paul. Since graduation he has been with the St. Paul Gas Light Company as cadet engineer.

Ill fortune seems to have dogged the steps of **Irwin L. Boyum**, E. E. '17, for the past year. On May 14, while engaged in duty as assistant city engineer at Watertown, S. D., he came in contact with a live wire and was severely injured from the fall to the ground from a pole. For many weeks he was confined in a hospital with his knee in a cast, but was finally able to come to his home in Prospect Park and to be about with the aid of crutches. Then on September 1 he was operated upon for appendicitis, following a sudden attack. However, he was able to leave with his family for Watertown on September 21, and will stay for the winter, completing some inside work for the city. We sincerely hope that the jinx will leave his path, having given him enough bad luck to suffice for some time.

George Swift, E. E. '23, was visiting at the University Tuesday, November 27. George is working for the city of St. Paul. His work consists of testing materials for municipal work and testing electric meters. Since he took this position on September 1, it looks as if he was preparing for the customary "job for the winter." His mail will reach him at 1514 2nd Ave. So., Minneapolis, Minn.

CHEMISTS

Carl A. Taylor, Arts and Chemistry '09-'10, is living at 4800 Forbes Street, Pittsburgh, Pa. He is employed as explosive chemist by the Pennsylvania Bureau of Mines since 1920. Previous to this time he was with the Western Cartridge Company as superintendent. Mr. and Mrs. Taylor (Margaret Smith, Arts '13) have two children, Fred, age 6 years, and Kathryn, age 8 years, attending Edgwood School.

We were snooping around town the other day and ran into an influential alumnus. He is living at 3948 Ewing Ave. So., but who cares where he lives? **C. C. Westerberg**, Chemistry '21, is in the employ of the Minneapolis Brewing Company as chemist and superintendent of the preparation department. Before he took his present position on November 19, 1923, Mr. Westerberg was a chemist with the Northland Milk and Ice Cream Company.

Elmer A. Daniels, Chemistry '12, Ph.D. '17, is living at 3546 Kenilworth Avenue, Berwyn, Ill. He has been employed by the Western Electric Company since August 1, 1917, as chief of the Organic Insulation Development Division at the Hawthorne Station in Chicago. From 1913 to 1917 Mr. Daniels was an instructor of organic chemistry at the University of North Dakota. On June 13, 1917, Mame Goodwin, a 1921 graduate of the University of Chicago, and Elmer were married. They have two children, both girls, one 4½ years and one 1½ years old. Mr. Daniels is a member of Sigma Xi and Phi Lambda Upsilon.

Myron B. Jackson, Chemistry '05, is living at 513 Second Avenue West, Williston, N. D. He is with the Williston Grocery Company, a wholesale concern, as treasurer. (These engineers are bound to stray to other fields.) Previous to his present position, which he took in 1913, Mr. Jackson was employed by the By-Products Coke Corporation of Chicago as chemist. The family consists of his wife (Clara Wolff, of Grand Forks, N. D.), Robert, age 3, and Elizabeth, age 8. Mr. Jackson is a member of Phi Kappa Psi and Alpha Chi Sigma.

John H. Spicer, who was registered in the School of Chemistry, is living at Wiarton, Ontario, Canada.

John had to leave school after his freshman year, ill health preventing him from completing the course. He was a member of the class which will graduate in June '24.

MECHANICALS

Major H. P. Councilman, M. E. '08, is employed as mechanical engineer in the research laboratory of the Doble Steam Motors Corporation of San Francisco. When we mentioned this bit of news to one of the senior mechanicals he asked if this research work ever turned up any jobs for the graduating men. From the way our Alumni stand behind each other we say "yes."

Arthur W. Sear, M. E. '23, is living at 432 Clement Avenue, Milwaukee, Wis. He is employed by the Norberg Manufacturing Company as draughtsman.

Edward F. Critchett, M. E. '13-'14, is teaching auto repairing in the Minneapolis Edison High School.

MINERS

Lyndon L. Foley, a geologist of the class of '18, has returned to oil fields of Oklahoma, after spending a vacation of several weeks in Minneapolis. "Lyn" is doing exploration work on his own behalf.

John L. Middleton, M. '23, returned to Minneapolis from Miami, Arizona, where he has been engaged in geological work. "Jack" has signed up with the Societe Internationale Forestiere et Minere du Congo and is due to sail from New York January 17, for Belgium Congo to prospect for gold and diamonds.

Roger W. Gannett, M. '18, called on his former instructors in the School of Mines, recently, and announced that he has resigned his position with the Alleghany Mining Company of California to teach geology at Lansing, Michigan.

Donald H. Wolfer, M. '23, is on a month's vacation visiting at his home in St. Paul. Mr. Wolfer has been employed as a geologist at Shelby, Montana, by the Campbell Oil Company, and is leaving soon for Alabama, under the employ of the same company.

Carl H. Sebenius, M. '21, stopped off for a few days in Minneapolis while en route to his home in Duluth. Mr. Sebenius has been in the employ of the Lafayette Fluorspar Company at Mexico, Kentucky.

Frank E. Mooney, M. '23, is in the open hearth department of the Lackawanna Steel Company at Lackawanna, New York.

Mr. Wen Ping Pan, M. '19, of Hibbing, Minnesota, and Miss May Hum, of Minneapolis, were married recently.

E. C. Sponberg, M. '23, visited at the School of Mines last week. His address is care Berkshire Mine, Mellen, Wisconsin.

Bob Ridgway, M. '23, and Miss Bernice Berg were married on December 29. The Ridgways are now at home at 1903 Stevens Ave. So., Minneapolis.

Arnold Gustafson, M. '23, was in Minneapolis during the week of December 17. "Gustie" represented the George H. Crosby interests at a series of tests conducted by the Bureau of Mines at the Experiment Station. These tests were made on iron ore from the Kennedy property at Cuyuna, Minn., and were for the purpose of determining this ore's adaptability to concentration. The success of these tests will considerably increase the tonnage of marketable ore on this property, and eventually lead to more extensive developments on the Cuyuna Range.

The following letter was received from Lenard T. Johnson, E. E. '10. Right here and now we want to say this is the way we would like to have all our alumni act. Such an action helps the alumni editor, the dean's office, and is news to the boys in the field.

Cleveland, O., Dec. 28, 1923.

The Minnesota Techno-Log,
Main Eng. Bldg., U. of M.,
Minneapolis, Minn.

Dear Sirs:

I received the census card sent me and after partially filling it out I have changed my location. Up to December 15 I have been with W. J. Rainey, Inc., of Uniontown, Penna. Since that date I have become associated with The Grasselli Chemical Co., of Cleveland, O. My work with the Rainey organization was as an electrical and mechanical engineer; my present work, as assistant steam engineer.

Will you please send me another census card so that I may fill it out? My family has not moved to Cleveland as yet and so I must give my address at my place of employment.

LENARD T. JOHNSON, E. E. '10,
Eng. Dept., The Grasselli Chem. Co.,
14th Floor Guardian Bldg.,
Cleveland, Ohio.

My former address:
Lebanon Avenue, Uniontown, Penna.

The following communication was received from Carl Aslakson, C. E. '23, on board the launch "Elsie III," U. S. Coast and Geodetic Survey, Fernandina, Florida:

"I am en route to Lake Okeechobee, Fla., which body of water we're going to chart and sound. We left Baltimore on the 7th of November. It's slow work on this boat as we travel only in day time and are taking the inland route through rivers, canals and sounds. It is a 50-foot launch and too small to make a long trip outside. However, in some places we have had to go outside and on one of those occasions a gale came up which very nearly put yours truly and the others aboard down in Davy Jones' locker.

"These coastal rivers are mostly tidewater streams and are connected by canals without locks so that you can sail up one, cross over by a canal and sail down another. Then there are many sounds, too. The route is long but picturesque in many places.

"Had Xmas dinner in Charleston as the guest of the officers aboard the Lydonia, a Coast Survey yacht stationed there. It was a fine dinner and we had a good time. We played golf on Xmas day, too, something a little new to me for that time of the year.

"Address mail to Carl I. Aslakson, care of U. S. Coast and Geodetic Survey, Washington, D. C."

(Continued on page 24)

EDITORIALS

EXAMINE YOURSELF

What are you doing for your university? Are you helping to make it a better institution of learning, a better community in which to live, a better center for athletic contests; or are you standing back and letting "George do it"?

This is the beginning of a new quarter and of a new year, an excellent time to examine yourself. "Oh, but I cannot do anything outside of my studies," someone remarks. Very well, if it is necessary, and if you do put all of your time on your studies we admire you for it. But, are you sure that there are not a few evenings when all you do is sit around and talk, or that there are not a few hours during the day when you could be helping your alma mater, which you spend in the halls of the buildings doing nothing?

Innumerable organizations on this campus are doing a great service to the university, a service in which any man is welcome to help. You can readily find an opening in one of these organizations where your services will be appreciated, not only by the members of the group, but by the whole university.

Certainly every man in this college can find something worth while doing in such a great organization as the Y. M. C. A. We have heard some say that the "Y" is laying down on the job, but had these men been in the hospital or the Health Service at any of the Wednesday noon meetings, or at any of the parties given in the new building, they would feel differently. Certainly the "Y" has been trying to get you to join them in their work and good times. Does not part of the responsibility rest with you?

The man who continually takes in and gives nothing in return will soon have his little realm completely dammed against any outside interference. Examine yourself, look over your possibilities and make the most of your opportunities.

"THEY SHALL NOT PASS"

It is with a feeling of disgust and disappointment that the upper classmen learn of the policy which one of the new members of the faculty has seen fit to carry out. We are ready to admit that real scholars and mathematicians are not so very numerous, but we fail to appreciate a policy or point of view which justifies the flunking of about four-fifths of the members of a group of average sophomore students.

We have been in the habit of thinking that our work here at school should be attended by a certain division of responsibility. The student is in duty bound to his college, to his parents, to his commonwealth and to himself, to do his best while here at school. On the other hand, the faculty should, and we are glad to say that in ninety-five cases out of every hundred, does assume the responsibility of helping the student do his best and aids him in developing a mind capable of real reasoning and analysis. The public has faith in the students here at its university, otherwise it would not continue to give them their financial support.

The students, in the group under discussion, had successfully completed their high school work and one year of college work. They had enough interest in education to attempt to continue their work in this institution of learning, and to spend their money in hopes of getting some of the things which a great university is capable of giving. They do not expect to receive without giving, but when they get an instructor who apparently has the motto, "They shall not pass," and who attempts to claim that not one man among the fifteen or twenty in his class is an average student, they have a right to stop and review the situation. It is almost beyond our belief that any one instructor should be unfortunate enough to get a whole group of students whose mentality and capacity for learning is below the average. The other possibility is that a group of students have been unfortunate enough to get an instructor who does not, or is not capable of doing, what the students and the public have a right to expect. If the instructor feels that he is not fitted or able to teach sophomore mathematics to an average degree of perfection, then no one will think the less of him for admitting his shortcomings and leaving the teaching field to others. In case the trouble is with his methods, then let us hope that he will attempt to learn some of those followed by the majority of instructors, who are capable of finding, or developing, in the average group of students, one or two of average mentality.

L. A. T.

A VITAL NEED

There has been a constantly growing conviction among the upper classmen that more and better courses of a general nature should be required of the Engineers. When the men arrive here as freshmen, they are hungry for facts and technical knowledge. They think that Rhetoric and Public Speaking are necessary evils and take them with the idea of disposing of them with as little effort as possible. When the same student becomes a senior and is about to embark upon life, he sees these things in a different light. He has formulated new ideas and has learned many facts, and wishes that he had the ability to express them clearly and emphatically. True, he may never become an orator, but if his ability along that line can be improved 50 per cent, he is repaid a hundredfold. After graduation, the college man is not judged by the courses he took at college, but by the ability he is able to manifest at the time. Nothing is more readily recognized than a man's inability to speak his mother tongue correctly or to express his ideas with appropriate words.

G. A. Young of Purdue University recently sent out about 200 questionnaires to graduates who had been out in practice from five to twenty years, ask-

(Continued on page 32)

COLLEGE NEWS

ARCHITECTS

DECEMBER DESIGN AWARDS

SENIOR SHORT

An Entrance to a Stadium

Mention Held:
H. A. Magoon

Mention:
Wallace C. Bonsall

SENIOR SHORT

An Airplane Reception Station

Mentions Held:
I. Woodner Silverman
C. R. Barnum
H. A. Magoon

SENIOR ESQUISSE-ESQUISSE

A Summer Colony

Credits:
Glanville Smith
I. Woodner Silverman
C. H. Hinman

JUNIOR LONG

Headquarters for a National Professional Society

Mentions:
Everett Peterson
P. P. Bross
Rahel Rosenberg
A. E. Rigg

JUNIOR CONSTRUCTION

Exterior Details

Mention:
E. W. Molander

JUNIOR ESQUISSE-ESQUISSE

A Belfry

Mention:
Dorothy Brink

INTERIOR DECORATION 2ND

Mirrors in Various Styles

Mentions:
Gladys Hernlund
Alberta Eberhart
Helen MacGregor

INTERIOR DECORATION 3RD

An Office for the President of a Large Corporation

Mentions:
Helen MacGregor
Alberta Eberhart

INTERIOR DECORATION ESQUISSE-ESQUISSE

A Wrought-Iron Lantern

Conditional Credit:
Alberta Eberhart

SOPHOMORE LONG

A Loggia

Mentions:
Rhoda Coté
J. T. Grisdale
Otto Person
Dorothy Mann
Mary Slocumb
Samuel J. Sutherland
Claude Flegal
Porter Kilpatrick
Verna Smith

SOPHOMORE SHORT

A Library for a Small Town

Mentions:
Mary Slocumb
Bernice Kimmerle
Verna Smith
Alvin Jansma
Helen Parker
Dewey Gerlach

SOPHOMORE ESQUISSE-ESQUISSE

A Gasoline Filling-Station

Mentions:
Bernice Kimmerle
Porter Kilpatrick

THE DOMESTICITY OF ARCHITECTS

Architecture, as Mr. R. C. Jones has fitly expressed it, is, next to plumbing, the dirtiest profession known to civilized man. How true! And yet this patent fact is quite ignored by the great world, which still continues to regard architecture as a neat and tidy pastime. The client fancies his architect as strolling into the office of a morning, sniffing perchance at some sweet sprig of verbena held in his lily hand. A pencil stroke here, a judicious erasure there, and then a studious but not displeased survey of the finished morceau through half-closed eyes: this completes the day's work. Our hero now retires, bowing indulgently to the office staff, meanwhile sniffing again at the verbena in his still lily hand. And so to the afternoon siesta, with "House and Garden" to lull him to soft semi-professional reveries, and soon to dream-soothed slumber.

Likewise, when Aunt Irmengarde inquires what course it is that little Oswald is taking down at the "U," and is told that Oswald is studying architecture, does Aunt Irmengarde picture Oswald boiling himself in a steam-seethed bathtub, to remove, in part, the graphite which has been embedded in the outer surface of his anatomy? No, Aunt Irmengarde sees not those inky elbows, nor the sooty twilight of that leathern neck. Perhaps the image I have suggested is too libidinous for Aunt Irmengarde's well-bridled imagination. It may be a fairer test to ask, does Aunt Irmengarde see Oswald conspicuously collarless, unshaven, and tousled of head, garbed in a shrunken remnant of a smock once green but now a dreary burlesque of a "heather mixture," swearing over the adhesive qualities of paste lately cursed for its lack of these self-same qualities, as he labors to clean his board at the sink? No, never! Aunt Irmengarde sees Oswald through a golden haze of professionalism, ministered to by the genii of the Parthenon, Notre Dame de Paris, and the Woolworth Building. While we paper our scholastic parlor with hard-earned credits, sweep up portfolios of history-note dust, walk the floor o' nights with some howling infant sketch-problem, or knock our shins against the ever-present rocking-chair of mathematics, Aunt Irmengarde and all the world fancies us as wooing with winsome wiles the dainty muse. We are pictured as actors in some Fragonard fête champêtre. Nay, nay! Aunt Irmengarde. When we engage in any wooing of the muse we do it rolling-pin in hand.

Ours is a strenuous household, no doubt, but after all we find it somehow conducive to happy living. Let the waste paper accumulate desk-high, we shall still wade through, whistling no whit less joyously. Let the sable-hair brushes, the innumerable erasers, the moss-covered paint-pans so dear to our hearts vanish into the limbo of the borrowed—work still goes on, and so do we. Let the lights swing ever so high and burn ever so dimly, we still shall toil all through the night and fail not to crack jokes over the misfortune. Let our infuriated parent in his first-floor den threaten spankings and other chastisements ever so many, we still shall penetrate to these dear halls on Sundays and holidays.

We are a large but delightful family. We treat our morons kindly. We admire our geniuses. We are all excited when Ed. Molander appears in his God's Country shirt whereon black checks two inches across nudge and jostle white checks of equal size. We beam unanimously when Cy, Sam, and others appear headlined in the daily press. We cluck like hens over the latest pamphlets and announcements of exhibitions strewn across Mr. Burton's always interesting desk. We observe with pleasure how many clumsy hands are ready to assist Miss Harwood in the raising of a library shelf that Close's portfolio cover may be more conspicuous to the passing eye. And how touching to see Dorothy Brink, Pete Bross, Rosie, Glanville, Ted Krafft and Jerry Kronick helping Izzy to get his problems in almost on time. Bonny is absent on a criticism day: Papa Arnal remarks, "Too much Sunday?" We smile; then scowl as a million or two of drawing boards crash to the floor in Ted Krafft's vicinity.

But never mind. Be it ever so tumultuous, there's no place like Home.

TAU SIGMA DELTA

At a dinner at the Chateau on December 13, three new members were initiated into Tau Sigma Delta, national honorary fraternity in architecture: Dorothy Brink, Edwin W. Krafft and Glanville Smith.

MECHANICALS

THE WORTHINGTON SOLID INJECTION DIESEL

The newest and probably the most interesting engine in our laboratory is the Worthington Diesel. This engine has aroused a great deal of interest among the students and it is largely because of this interest that this article has been written. It is assumed that the reader has a certain amount of knowledge of the steam and gas engine. No attempt will be made to give a comprehensive discussion of the Diesel engine and its many advantages and still more numerous variations except as these subjects bear on this article.

The distinctive feature of the Diesel type of internal combustion engine is that air is compressed to such a high pressure in the cylinders that the resultant high temperature of this compressed air is sufficient to ignite the fuel oil at the moment of injection. During the period of injection, the pressure is maintained almost constant and this is what distinguishes the Diesel engine from other types of internal combustion engines in which a decided rise in pressure occurs during a very short period of rapid combustion.

The two functions of charging the cylinder with air and injecting the fuel charge into the cylinder have been solved in a great variety of ways. In the four-cycle Diesel it is customary to admit the air into the cylinder through inlet valves much the same as the moisture is drawn into the cylinder in the conventional automobile engine. In the two-cycle Diesel, the cylinder has ports cut in it so that these ports are uncovered at outer dead center and then air under slight pressure is blown into the cylinder and thus drives out the burned gases and charges the cylinder with air for the next compression stroke. In the Worthington engine the air is drawn into the lower end of the cylinder and is there compressed to a low pressure and forced into receivers in the frame, from where it passes through the inlet or scavenging ports into the cylinder at the end of the power stroke.

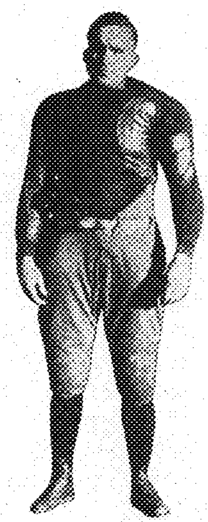
The feature which distinguishes the Worthington engine from the so-called "conventional" Diesel is the method of injecting the fuel into the cylinder. In the "conventional" Diesel, it is injected into the cylinder with a blast of air at high pressure. A certain amount is pumped into the spray valve and at the proper time another valve is opened and this fuel is sprayed into the cylinder with the air. The Worthington Diesel uses a different system, known as the solid injection, which is combined with a "two-stage combustion." In this engine, the combustion chamber is divided into two parts. When the piston is at top dead center, the chamber between the top of the piston and the cylinder head holds about three-fourths of the air. The other one-fourth of the air is held in the injection chamber.

The fuel injection pump, which also acts as a fuel metering pump, injects the fuel as a spray directly into the injection chamber, where the full charge of oil cannot meet more than one-quarter of the air. Part of the oil injected into the injection chamber is burned. The heat from this partial combustion gasifies the remaining oil and also increases the pressure within the injection chamber. This gasified unburned oil, which includes the bulk of the charge delivered by the pump, is forcibly ejected into the cylinder through an orifice which separates the cylinder and the injection chamber. As this gas emerges from the orifice, it burns in the main cylinder as fast as it flows through the orifice. A violent mixing action is set up by the high velocity through the orifice and this is said to contribute to good combustion. The amount of oil injected by the fuel pump is controlled by a governor and thus the speed of the engine under varying loads is held quite constant.

The engine in the laboratory is the smallest size in which this type of engine is made at present. It has a 10¼-inch bore, a 10½-inch stroke and is rated at 30 horsepower at 375 r.p.m. The engine is an attempt to build a simplified Diesel in the smaller ranges of power. When compared with the Maries Diesel, we can readily agree that this engine is a step toward simplicity. The success and efficiency of this engine are beyond the scope of this discussion. At present Carl W. Keiser, post senior mechanical, is engaged in a series of tests on this engine, the results of which should be of interest to all who are interested in this field.

GREETINGS "STEW"

After many long and dreary weeks of patient suffering in the Health Service, "Stew" Willson has again taken up the usual walks of life. While "Stew" spent many dreary and painful hours on his back, there was also a dark cloud hovering over the Mechanical Building. During that time, our hopes surged up and down the scale of life but they have come to rest at the proper point again since "Stew" joined the gang. No one can better appreciate what it means to lie still for forty-eight hours and wait for a cast to set than Stewart. This same cast, however, gave him considerable satisfaction because he had practically every one of his friends write his name on it. Today he is probably running around carrying with him everywhere he goes the autographs of a majority of his pals.



It was during the game with the Haskell Indians that "Stew" received this injury which so abruptly ended his brilliant football career. One of the vertebrae of his back was crushed and how he escaped further injury is not for us to know. If this same vertebra had slipped instead of crushing, all probable chances are that today someone would be wheeling him around in a chair. As it is, he has again assumed his former position and is taking his usual active part in campus activities. Just recently he was given the position of (whatever you call it) and so will take an active part in the Senior Prom.

PROF. ROWLEY REPRESENTS A. S. M. E. AT NATIONAL CONVENTION

At a meeting of the A. S. M. E. held Saturday, December 15, Professor Rowley gave a short sketch of the National Convention held in New York on December 5. It gave us considerable satisfaction when he told that we were the only student branch having an enrollment of 100 per cent in the senior class where membership was not compulsory. He also said that we were the only student branch where there was extended and successful co-operation between the student branch and the local chapters.

Mr. Sampson also gave a talk on his engineering experiences. They were all interesting and instructive. Perhaps the best advice that he gave was not to be too severe in criticizing the mistakes of

CHEMISTS

A SWEET TRIP

On Saturday, December 12, Dr. Mann's class in Industrial Chemistry, augmented by a carload of other curiosity seekers, journeyed to Chaska, Minnesota, to inspect the sugar plant there.

The Minnesota Sugar Company, as the visitors found, has a large plant which is operated in a seemingly very efficient manner. The process which changes the heaps of dirty sugar beets stacked along the railroad tracks to hundred pound sacks of beautiful white sugar is a fascinating one. The washing of the beets, the cutting, the treatment in diffusers, the liming, the concentration, the crystallization, the filtration, the drying and the packing and shipping processes work like clockwork and a steady stream of beets entering the plant is exactly counterbalanced by a steady stream of sacks of sugar passing out. The size of the plant is shown by the fact that from 200,000 to 250,000 pounds of sugar are produced daily; and that during the campaign, which lasts about a hundred days, the output reaches several million pounds of sugar.

While the inspection of the plant was the chief attraction of the day, there were other events which were fully as interesting as the inspection trip. The "red band" which provided the means of transportation was the scene of several friendly jousts. "Fuzzy" and others were guilty of straining a pane of glass beyond the yield point; Cecil and "Goof" ably entertained the towns en route with their canine imitations; "Rudy" displayed a little inside dope; and practically all the occupants of the bus engaged in a battle for possession of a hosiery advertisement. Dr. Mann and the driver ably guided the bus to Chaska after going half way to Mankato in doing so. Most amusing of all, perhaps, was the elusiveness of the National Hotel. Somehow it could not be found in Shakopee, Jordan or Belle Plaine, even though its location was plainly known to be Chaska. When the hotel was found, the entire party was delighted in determining the coefficient of turbidity of the water served thereat, and in inspecting certain specimens of Chaska femininity.

The driver brought home a wreck instead of a bus, and the atmosphere of the trip was not at all times fragrant, and someone escaped without paying his share of the bus fare; nevertheless, the trip will always remain a pleasant memory to those who attended.

NUMBER ONE

The series of lectures being given at the School of Chemistry under the auspices of Phi Lambda Upsilon, Iota Sigma Pi and Alpha Chi Sigma opened with a bang on Wednesday, December 9th. Before an audience which came close to filling the Chemistry Auditorium, Dr. C. A. Mann, Chief of the Division of Chemical Engineering, spoke on "Some Chemical Problems in Other Branches of Engineering."

To those who attended, little need be said—they heard much and enjoyed much. To those who did not, it is impossible for anyone but Dr. Mann to intelligently discuss the subject in anywhere near as interesting a manner as he did. Civil, Mechanical, Electrical, Architectural and Mining Engineers were all considered in this lecture; and many applications of chemistry and chemical engineering to these other branches were discussed. Even to the supposedly "all-wise" seniors in chemistry, the lecture was a revelation. After the lecture was over, all must have wondered how these other branches of engineering could possibly exist without the aid of the chemist.

The next lecture in this series will be given by Dr. Ruth O'Brien of Ames. Her subject will be "The Chemistry of Textiles." The date has not been definitely announced, but one may be assured that it is worth watching for. If you cheated yourself by not attending the last lecture, don't do it again.

The remaining lectures are as follows:

Wednesday, February 20th—"Chlorophyll," by Dr. Willaman of the University Farm.

Tuesday, April 8th—"Modern Theories of the Structure of the Atom," Dr. F. H. MacDougall.

Tuesday, May 6th—"Some Problems of Biochemistry," Dr. R. A. Gortner.

All these lectures will be given in the Chemistry Auditorium at 8:00 p. m. on the day stated.

PERSONALS

R. W. Krantz, C '24, has been pledged to Tau Beta Pi, honorary engineering fraternity.

Frank C. Kracek, who was a graduate student in the School of Chemistry, has accepted a position with the Geophysical Laboratory at Washington, D. C., and left recently to begin his work there. Mr. Kracek was DuPont Fellow at Minnesota last year.

ELECTRICALS

The student branch of the A. I. E. E. held its second meeting of the year on Wednesday, December 12, at 6:00 p. m., in the Union. After absorbing the well known Union "banquet" we were treated to a come-back staged by Prof. R. E. Kirk, who will be warmly remembered, by the seniors at least, as the man who led our faltering footsteps through the complexities of H_2SO_4, $KMnO_4$, and the like when we first hit this institution of blue slips and Students' Work Committees three long years ago. It sure did seem like old times to hear a few of his rare Scotch stories and then settle back and get the latest on "Electro-Chemistry." In his talk Professor Kirk pointed out the relationship existing between the field of the Chemical Engineer and that of the Electrical Engineer, and urged active co-operation between the followers of these two branches of engineering for the good of humanity as well as for their own good.

On the same program with Professor Kirk was R. E. Mathes, a senior, who gave a brief résumé of the advanced work done and the important developments brought out by the students and faculty of the radio section of the electrical department. He also pointed out the work now being done and that yet to be undertaken in the radio field. The meeting adjourned to the west wing of the Union where motion pictures of the construction of the Sanganamo watthour meter were shown.

Eta Kappa Nu, honorary electrical engineering fraternity, the Minnesota chapter of which was founded in 1920, recently announced the election and initiation of the following men: Hoyt R. Cass '24, Hugo H. Hanft '25, Raymond W. Keller '25, and Henry R. Reed '25.

Yea, verily doth danger surround us on all sides! No longer can the poor, much-abused engineer venture forth wearing so much jewelry as a student member's pin of the A. I. E. E.—for did not ye scribe observe with his own eyes the spectacle of a s. y. co-ed sporting such a pin? Brethren, take heed lest ye also lose your badge of membership in the A. I. E. E.!

C. M. Jansky, Jr., professor of radio engineering, has just returned from the convention of the Fourth Federal Radio Inspection District, which was held in Atlanta, Ga., December 27th, 28th and 29th. Because of his national prominence in radio affairs Professor Jansky was asked to deliver one of the major addresses at the convention.

H. J. Walls of the U. S. Bureau of Standards in Washington visited the radio department recently on his way to California. Mr. Walls is arranging tests between WWV of Washington; WLAG, the Cutting & Washington station; 9XI, the University station, and the radio station at the University of California, in connection with standard wave transmission work carried on by the Bureau. These tests are to be conducted during the Christmas vacation. The University station has been actively connected with these tests since their inception nearly a year ago.

We believe in learning some new thing every day and take this opportunity to thank the professor in the School of Chemistry who taught us the dangerous character of the OHM. This professor had some apparatus which he did not wish to have disturbed by the janitor so he put up a big sign bearing the inscription:

DANGER—1,000,000 OHMS!

And now a street car conductor blames this nice, mild weather onto "unexpected electricity in the air due to so much broadcasting!"

It has just been discovered that those beautiful steel radio towers on the new building were designed by a Minnesota man, Ed. Sosznick, C. E. '21. During the erection of the first tower the middle section, some thirty feet long, nearly broke away from the workmen and caused some high excitement for the rest of the day. It seems that the section was grappled a little below the center of gravity and when it was raised free of the supports nearly turned over. But all's well that ends well and both towers are now rearing their proud heads over the campus.

CIVILS

OUR NEW ORGANIZATION

The Rubber Chain, a new organization for civils, is in process of formation. Tentative constitution and by-laws having been drawn up and approved. The movement originated with the seniors and met with such enthusiasm that every senior eligible to join is now a member.

While realizing the fact that the campus is already over-organized, its sponsors feel that the Rubber Chain will fill a definite need and find a permanent place for itself among campus organizations. Mr. George Bestor, acting as promoter, had the following to say in regard to the organization:

"The motive or idea back of the Rubber Chain is the grouping together of men of like ability and methods. Our experience at camp last summer was that in running the last side of a traverse we would need, let us say, 84.42 feet to make it close, whereas the distance on the ground as chained by the ordinary chain or tape was found to be, say, 242.04 feet. This difficulty seemed insuperable until the discovery of the Rubber Chain, which could be readily stretched to span the gap and gave the desired leading, 84.42. An extension of the same theory gave us the elastic transit and the flexible level, and from then on we had no difficulty in obtaining good closures.

"Membership has been limited to exclude any one who has a record of failure in any subject, as it is felt that a true Rubber Chainer will get fair marks with a minimum of effort. On the other hand, Tau Beta Pi's are ineligible, since it was our observation at summer camp that they could not close their traverses under any circumstances."

MEMBERSHIP AMENDMENT

By a recent action of the Board of Direction, the By-Laws of the A. S. C. E. are amended so that: "Graduates recommended by the heads of civil engineering departments of their respective engineering colleges may, upon payment of $4.50, continue affiliation with their Student Chapters until the first day of the second January following graduation. During this period they shall receive the Proceedings and shall have the privilege of membership in any Local Section in the territory in which they may locate."

In this manner, by a merely nominal payment, young graduates may obtain practically all the privileges of Junior membership for about one and one-half years. Presumably, by this time, they will be both anxious and financially able to attain the next higher grade of membership. Although this movement may be primarily to the interest of the young engineers, it ought similarly to benefit the Society by attracting and keeping the promising graduate in touch with the highest engineering standards and ideals.

RULES FOR CIVIL COMPETITION

The Northwestern Section of the American Society of Civil Engineers presents the following rules governing the competition for papers to be presented by members of the University of Minnesota Student Chapter of the American Society of Civil Engineers:

1. For the purpose of encouraging engineering students in investigation and creative work, regularly matriculated students of the University of Minnesota, who are also members of the Student Chapter of the American Society of Civil Engineers, are invited to submit to the Northwestern Section of the American Society of Civil Engineers during each school year competitive papers for the following prizes:

2. One prize of Fifteen ($15.00) Dollars, either in cash or invested in standard technical literature, for the best paper presented by a member of the senior class or a graduate student, and a similar prize of Ten ($10.00) Dollars for the best paper presented by a member of any lower class.

If other than cash prizes be given, the recipient's preference in the matter of selection shall be consulted.

3. Papers may be prepared on subjects concerning the design, construction, or operation of engineering projects, or on subjects of broader interest such as the financial, economic or social aspect of engineering problems.

4. Papers shall be judged from the standpoint of cogency, thoroughness, originality, orderly and logical arrangement, expression, conciseness, and appearance.

5. Papers to be eligible must have been produced by their respective authors without assistance, except for the impartial advice and suggestion of the Professor of Civil Engineering, who shall attach to each paper a certificate that said paper has been so prepared, referring to the paper and author by the identification number mentioned in paragraph 9.

6. Papers must not, either in whole or in part, have been previously published, nor contributed to any other society.

7. No prize shall be awarded for a paper which in the opinion of the judges does not merit a prize.

8. Papers shall preferably not exceed 5,000 words and shall be presented in typewritten form with text on one side only of a good grade of white letter size paper.

Sketches, drawings, or photographs, if any, shall, unless inserted in the text, be on sheets of the same size as the text sheets or folded to conform thereto.

All sheets composing a paper, inclusive of drawings and photographs, so far as practicable, shall be assembled in flexible covers and securely bound as a folio. The title page shall bear the title of the paper and the identification number. Detached sheets of drawings, photographs and other exhibits, if any, shall each bear the identification number and shall be enclosed in a large envelope or other suitable container correspondingly numbered.

9. Papers shall not be signed by their authors, but each paper shall bear an identification number and shall be accompanied by a sealed envelope, bearing on its back a corresponding number, and containing the title of the paper and the author's signature.

10. Students wishing to enter this competition shall present to the Board of Directors prior to December 1 the title of their paper together with a brief outline indicating the general plan to be followed, using the identification number as indicated in paragraph 9.

11. Papers shall be submitted to the Board of Directors prior to May 1 of each year.

12. The Board of Directors shall act as judges and shall announce the award of and present the prizes at the May meeting of the Section, at which time the prize paper or papers shall be presented.

The Board of Directors is authorized to revise these rules from time to time as it may consider desirable.

The above rules were adopted at a meeting of the Northwestern Section of the A. S. C. E., November 23, 1923. The time for submitting a title and outline has been set forward to January 1 this year.

MINERS

SCHOOL OF MINES SHINDIG

With the advent of the winter quarter comes the announcement of the Miners' Annual Shindig. As in former years, the sophomore class has charge and Elliott Griffith, their president, announces the date as Friday evening, January 25, at the Minnesota Union Ball Room. Come on, Miners, buy your share of stock in Shindig Mines, Inc., and make the affair, not alone a good prospect, but also a successful development! LET'S GO!

Mr. and Mrs. W. J. Early of St. Paul announce the engagement of their daughter, Mildred, to Robert C. Johnson, Ex. '25. We're waiting for the cigars, Bob.

MINERS BATTLE ENGINEERS TO SCORELESS TIE

On Saturday, December 1st, that "all star" School of Mines football team battled the Engineers to a scoreless tie. Now let us hear some Engineer refute the old saying that it is quality and not quantity that delivers the goods.

Much credit for our successful eleven must be given to Mr. E. L. Smith of the Metallurgy department, for the untiring service he rendered in coaching the team, and the team itself is to be commended for the fact that it played throughout the entire season without being scored upon.

Bernard J. Larpenteur returned January 4 from the national convention of the Theta Tau Fraternity, held at Iowa City, Iowa, during Christmas vacation. "Beany" met the Dean of the College of Education (and also part of the Dean's family) and now "he" is strong for Education.

"Vic" Mann is having a terrible time. Last fall he hurt his shoulder playing football and just the other day he froze all his toes while learning "Hockey and How It Is Played," from Coach Iverson. As soon as he gets the desired funds, "Vic" says he is going to buy a wheel-chair and a couple of yards of Climax and then apply for entrance to the Old Folk's Home.

NEW COURSE IN SCHOOL OF MINES

Practically a new course is now a part of the curriculum of the School of Mines. The senior miners are taking work under the supervision of Mr. E. W. Davis at the Experimental Station. This course is unique, both in the manner in which it is presented, and in the preparation of the reports to be handed to Mr. Davis for his approval.

Officially on the books as a laboratory course in ore-testing, it is, however, one of such a nature that has long been desired in the School of Mines. Because of the organization of the working staff in the station, and also the rules and ethics which govern the work, it is impossible to allow the students to conduct their own experiments. The actual work necessary in the running of a test is performed by the experienced men of the Experimental Station staff. In this way, no time will be wasted in unnecessary work, of which we would probably do considerable. All data taken will be furnished to the students. Questions relative to the work being done, which are asked by the class, will be fully answered at all times. This method will permit the student to obtain a more thorough understanding of what is being done, as his time will not be taken up by the intricate operation of one small valve or the reading of a certain scale.

From the data thus obtained, technical reports are to be prepared. No outlines for them have, or will be given to the class. The students are to use their judgment as to the relative value of the data, computations to be made, and conclusions to be drawn. Graphs and sketches are to accompany these reports at the discretion of the individual. The technical men of Mr. Davis' staff, as well as Mr. Davis, will give advice and help in the preparation of them.

From present indications this course offers wonderful opportunities and will provide invaluable training. Mr. Davis will probably give considerable advice and assistance but he can be sure that his time and efforts are appreciated.

ENGINEERS' DAY CHAIRMAN TO BE ELECTED JANUARY 25TH

All Juniors in the College of Engineering and Architecture and the School of Chemistry will vote for Engineers' Day chairman on Friday, January 25th. All Juniors who are considering this office are urged to circulate their petitions immediately. In order to have their names on the ballot the petitions must have the signatures of twenty-five accredited Juniors. The petitions must be turned in to P. O. Box 2287 before noon on Thursday, January 17. A filing fee of 25 cents must accompany each petition.

Ever since the birth of Engineers' Day at Minnesota the day was celebrated on St. Patrick's Day, March 17th, of each year. Last year Engineers' Day was changed to the Spring quarter. From the day of the change in date there has been considerable discussion pro and con regarding the advisability of making the change. At a recent meeting of the Technical Commission the question came up for considerable discussion and it was thought best to refer the question to the engineering student body for a final decision.

Before voting on this question the student body is asked to consider carefully the following points for and against the change in date: It is a tradition in the college that Engineers' Day should take place on St. Pat's Day. The knighting of the Seniors falls most appropriately on that day; one-half of the Senior Civil class graduates in March and could have no part in the celebration if it were held over until the Spring Quarter; and most of the institutions having chapters of the Association of Collegiate Engineers observe the day on March 17th. The arguments for the change are that March 17 falls a day or two before final examinations. The faculty contends that the day would interfere with the student's preparation and lower marks would result. The day is in a season of uncertain weather, whereas a few weeks later much more favorable weather is a likelihood. It is said that the change will benefit the student body without materially affecting the day.

Every student in the college is requested to go to the polls on January 25 and express his preference in regard to the two dates.

WESTERN ALUMNI ASSOCIATION MEET

The Tenth Annual Smoker of the Western Conference Alumni Association of Pittsburgh, Pa., was held in the Fort Pitt Hotel, Pittsburgh, on December 8. About 300 men were present to hear the speakers, Major John L. Griffith, high commissioner of the Western Conference Athletic Association, and Dr. Edward C. Elliott, president of Purdue University.

Steps were taken at this meeting to organize a permanent club to be known as "The Western Conference Alumni Club of Pittsburgh," with a charter membership of 400. Twelve of the Minnesota alumni attended this meeting and their yells and songs were much in evidence during the evening, especially the locomotive yell and "Ole Olson, Yohn Yohnson."

The following Minnesota engineering alumni were present: H. A. Dahl, E. E. '22; S. A. Berg, E. E. '22; W. G. Briggs, E. '23; N. C. Towle, E. E. '13.

EXTRA!!!

Sam J. Sutherland has finished his education at the University of Minnesota. Although we expected this to happen some day, the realization is a bit more than we can normally stand. Sam started as a civil but decided that architecture was more to his style. (Another good man gone wrong.) Our space is limited to the extent that we can not give a complete list of Sam's activities during his sojourn at Minnesota. He was editor of the Techno-Log last year and is editorial counsellor this year. Sam has been active in the Arabs as musical director. Now Mr. Sutherland is to be draughtsman, assistant superintendent, etc., working under F. M. Mann for the "U" stadium.

"BILL" GRISWOLD STEPS OFF

W. R. Griswold, M. '23, was married Saturday, December 15, at 7:00 p.m., at the Church of the Ascension. The bride was formerly Miss Edna Lamb, the daughter of Mr. and Mrs. Charles Lamb of Minneapolis. Mr. Griswold was very active in the Stadium Drive. He is a member of the Sigma Rho fraternity. Bernard Hutchinson was the best man. It is rumored that the trio, Griswold, Miss Lamb, and Hutchinson, were all badly scared as it was their first offense.

TOYS ARE BIG PROBLEMS

Two very welcome letters were received the other day from Edward W. Leach. One contained a two years' subscription to the Techno-Log, while a few excerpts from the other follow. Speaking of the Irish banquet Mr. Leach says: "While I may not have been eligible for an Irish banquet in my college days, I could probably get in now if Mrs. Leach was along, although they would probably put me at the foot of the table." Speaking of Christmas he says: "We have come through very nicely except for the usual casualties to the dolls, engines, etc. I may be able to select mine equipment which will stand up, but I fall down woefully on toys for boys."

Mr. and Mrs. Rutcher Skagerberg, E. '15-'16, announce the arrival of a son, John Paul, on June 30, 1923. Mrs. Skagerberg was Elsie Schurr ('20 H. E.). They are living at 1620 Gladstone, Detroit, Mich.

TO YEE MASTERS

There has been some discussion from various sources regarding the practice in our Alumni section of using the abbreviations C. E., E. E., or M. E., as the case may be. We have found it difficult to designate the department to which these men belong in any other convenient way and at the same time to give their year without detracting from the news in the item. We trust that no one will misconstrue our intention in using this designation.

We realize that if these symbols were to be taken in the way that they are commonly used that there would be only a very few with the privilege of these titles. For this reason we feel that it will be considerably easier to state that "John Doe has received both a B.S. and an E.E. degree" while "Paul Jones, C.E. '21, ——" will indicate that the latter has merely a B.S. degree and that he was enrolled in the Civil department.

THE SECRET IS OUT

Our friend, "Admiral" Curry, has informed us of the late whereabouts of "Mike" Mitchell. He has been in the reformatory at Kearney, Neb., for three weeks, but they let him out so he could return home for Christmas. They gave him 3,000 demerits when he entered and cancelled 100 for each cigarette stub. Mike bought a carton of Camels and cut each Camel into three parts, lighted them, dropped and picked them up again. In this way he soon cancelled his 3,000. Ward & Weighton, contractors of Sioux City, Ia., have kindly taken him under their wing and he will be in their office after the first of the year.

OMAHA ALUMNI ORGANIZE NEW UNIT

A new group of alumni have come into the fold, for Minnesota graduates living in Omaha, Neb., met on November 3, 1923, and organized an alumni unit. The Minnesota engineers who attended the meeting are W. A. Zimmer, E. E. '06; W. M. Weibeler, E. E. '08; S. W. Lawerence, E. E. '15-'16; Edgar W. Christensen, E. E. '19; P. R. Wilson, E. E. '21; Robert C. Rome, E. E. '22; H. T. Eddy, E. E. '95-'96.

FINDS ALUMINUM PAINT MAKES RADIATORS LESS EFFICIENT

The aluminum or bronze paint generally applied to radiators greatly reduces their effectiveness and makes it necessary to have a larger surface for the same heating effect, according to experiments performed by Dr. W. W. Coblentz, of the Bureau of Standards. Doctor Coblentz finds that the heat radiated from an aluminum painted radiator surface is less than a third of that emitted by a radiator of the same size painted with a non-metallic paint, enameled, or simply allowed to rust.

On the other hand he finds that aluminum paint is a very effective means of reducing the amount of heat transmitted through a thin material. Applied to the under side of a tent or awning it reduces by three-fourths the amount of heat from the sun which gets through the cloth, while if used on the cover of an automobile or ice wagon it cuts in half the heat let through and makes the temperature inside the vehicle more nearly that found in natural shade, thereby making it much more comfortable.—Tech Engineering News.

THE COMPLETED ELECTRICAL UNIT

(Continued from page 6)

lateral trenches, 1 foot by 3 inches, have been provided so that a set-up can be made at any point on the floor. Each trench is covered with a four foot steel plate, and the trenches are so arranged that the removal of one steel cover at a junction point will give access to a lateral trench and to the wall trenches, and to small vertical shafts.

Again, in the basement of the laboratory, in each column and in the beam on both sides of the column is found a feature never before provided by any construction engineer in the country. At each column there are three channels running the full length of the basement ceiling. These channels run between the concrete joists, which are from 5 to 9 inches wide and from 8½ to 15½ inches deep, according to their span and load, but they cut a hole 9x3 inches through the concrete beams supporting the first floor on either side of the columns. There is also a metal duct passing through the top of each concrete column laterally and also vertically to minor switchboards built on the steel columns on the main floor. The holes in the beams are only a few inches from their point of support and therefore are almost at the point of maximum shear, while in the columns we find the hole at the point of maximum compression. It is not strange that the construction engineer had a real problem. It is believed, however, that the work in designing will be more than offset by the electrical advantages.

The placing of a small switchboard in the steel columns on the main floor, as mentioned above, caused another problem in design. The space necessary for the board made a large hole in one side of each column, thus reducing the radius of gyration and causing a large overturning moment. To remedy this condition and to relieve the strain it was found necessary to install a heavy steel plate about four inches back from the face of the column. Here again the electrical advantage gained outweighed the difficulty encountered in construction.

Under the north balcony of the main laboratory are two Westinghouse switchboards. One is a switchboard for the service lines, while the other is a plugboard for experimental purposes. The boards are directly over the tangle room, which is about three feet deep and serves as a convenient space in which to mount or to change the wires to and from the switchboard panels. A hole to the tangle room is directly behind each panel. They are partially covered with a cast iron cover, the removal of which will permit a man easily to drop into the space below. The front part of each hole is covered with an asbestos plate through which pass the wires to the board.

Two master clocks will adorn the walls of the new building: one on the east wall of the laboratory balcony and the other in the front hall. These clocks, although made to take care of gradual temperature changes, are very susceptible to sudden changes. Consequently both are being well insulated in order to assure the whole University that they will always ring the bells at the right time.

The freight elevator on the north will be used for all heavy machinery and other equipment. It has an "inching" device which permits it to be raised an eighth of an inch at a time when very close to the floor level desired. There is also at the east end of the laboratory a large door for the reception of very large articles, this being served by the crane and a snatchblock.

The building includes several special laboratory rooms where experiments can be set up and left undisturbed. Each of these rooms as well as each lecture room will have one or more panels from which one may obtain a D.C. supply at 220 or 110 volts, an A.C. single or three-phase supply at 220 or 110 volts, or any special circuit desired. In fact, the building has been made so thoroughly adaptable and convenient that even a compressed air line can be installed to serve all of the rooms without cutting a single wall or partition.

In the front end of the building there is to be an electrical museum showing the developments in the various lines of electrical engineering. Among the exhibits will be the first arc light machine used in Minnesota, the first alternator to earn a dividend in Minnesota, two samples of early train lighting outfits, and one of the first dynamos Edison ever sold. There will be a complete history of lighting devices from the pottery lamps of 700 B. C. down through oil, the candle and gas to the modern Mazda. There will be an extended line of electrical measuring devices and plenty of material on the development of devices used to make electricity safe, besides innumerable other features.

There is also planned a demonstration room equipped to exhibit various electrical phenomena and methods of using them for the service of mankind. It is expected that this room will be kept open for free observation and experimentation by students and by visitors.

The head of the building will also house the departmental offices and several lecture rooms, the largest of which will seat from 250 to 300 students. This room will be equipped with a lantern and motion picture projector and will be at the service of the A. I. E. E. whenever it is needed. It may also be of interest to note that the spaces between the joists of the ceilings act as air cushions which deaden the sound for the floor above. This and the fact that the construction was much lighter were the determining factors in choosing the "tin pan" type of supporting floors.

The construction, due to the mild weather, advanced more rapidly than was expected, and it appears now that everything may be completed by the first of April instead of by the first of May, the date set in the contract. The seniors are anxious to get to do a little work in the new surroundings and sincerely hope that they can spend most of the spring quarter there. Although we may not realize this, we have been assured that there will be an open house or some other type of entertainment furnished to all during commencement week. Much of the equipment will be installed by that time and we shall have the most modern and convenient electrical engineering building in the world.

Note: For much help and assistance in gathering my data and information I wish to express my thanks to Mr. W. B. Marschner, Superintendent in Charge of Construction, and to Profs. G. D. Shepardson and F. W. Springer of the Electrical Department.

"The Functional Plans of the Electrical Engineering Laboratories" will be fully outlined and discussed by Prof. F. W. Springer in our next issue.

ENCIRCLED WITH 110,000 VOLTS

(Continued from page 18)

is subjected to a special rolling process, removing a large amount of the air, and increasing the porcelain's specific gravity 20 per cent. All metal parts are drop-forged, hot-dipped, galvanized, and the cotter-bolt, which supports the insulator, is of vanadium steel.

When the complete loop is put into operation, the Northern States power lines will be more compact, and will be able to give the community better service. It will enable the company to effect a considerable saving, too, because all of the sub-stations in the vicinity will be connected to the line. When the river is high, the steam stations can be largely replaced by the water-power stations, and at times of heavy loads the entire system can be pressed into service.

BUILDING CONCRETE WATER TANKS

(Continued from page 8)

The peculiar success of the tank rests partly in the manner in which the steel rods are shaped to absorb the combined strains of weight, expansion, and bending, without allowing a tension upon the concrete, which would cause a water leak.

Perhaps the outstanding feature of the structure is the design of equipment. By means of special steel forms, which are bolted in place and are interchangeable, the length of the job is shortened to almost half the time of other methods of form building that have been tried. The distributing spout is convertible to be used as a hoist in placing the forms high above the ground. The entire layout is designed to permit greatest speed in construction with a minimum of labor. As the concrete sets the forms removed below are immediately swung into place above, and before the outer forms are off the tub the tank is ready to fill.

This article was not intended, however, to be a scientific treatise on the construction of a concrete water tank, but was only aimed to expose some of the contacts for which an engineering education prepares a man, for which he can be given no specific instruction. The whole profession is a combination of names and places, skill and common sense, and perhaps of most importance—people. The most ingenious scheme of design can fail if carelessly and thoughtlessly applied, and as the water tank at Robinson grew day by day I often thought how easily the reputation of the designer and builder might be permanently marred.

It would not be fair to leave the subject of Robinson without a word for its neighbor, Burntside. Many people are familiar with that vaunted stamping ground of the more delicate outdoor fiends, and those who dote to wait upon them. After our fifteen-hour run, known as the battle of the upper tub, we felt rather delicate and chose Burntside for our haven of rest. Attired in stately breeches of corduroy, and with pipe-adorned faces, we mounted the waiting hand-car and motored (yea, verily, how we motored) to the crossing. All that we had heard was true, and probably a lot more that we hadn't heard about. People were everywhere. Some of them had come five hundred miles so as to arrive in a place where it was proper to wear their outing costume, and once adorned therein they sat auspiciously on the veranda and read "Outing" and the "Call of the Wild." The weather was fine, and man hadn't been there long enough yet to mar the marvelous job that nature had done on the scenery. There were hardboiled mosquitoes, too, but they were particular and didn't hang around the lodge much.

They served meals there, or should I say food? We went in to dinner and were just nicely started when the people got up and left. I guess dinner was over and we didn't know it. What we had was not so bad, though—canned beans are always about the same. The bill for beans, bread and coffee only came to a dollar and a quarter. It was a good guess; we had that much. In spite of the pretensions of the would-be travelers, like ourselves, Burntside has many wonderful possibilities.

With the rest furnished by this pleasant jaunt we felt capable of higher things, so we returned to Robinson and finished the crowning feature—the roof.

THE APPRAISAL AND ENGINEERING

(Continued from page 11)

new and more expensive equipment was in the plant and destroyed, thus placing the proof of loss against the appraisal company.

In this connection it is well to call attention to some methods of bookkeeping, or the methods of some bookkeepers, whereby they will charge the entire expense of removal of an old machine, the cost of a new one, and its installation charge, to the Permanent Assets without deducting the book value of the old machine, the real reason for this being that it is impossible to determine from the books the real value of the scrapped machine nor is there any provision for "make ready expense." Then again it has often come to our attention where the entire cost has been charged to Expense.

It is my opinion that all accountants should provide a means whereby records of the costs of plant changes and improvements should be reported to the accounting department in such a manner as will properly guide that department in entering them on the books. For example a can of paint, a brush and four hours' labor repainting a partition should be charged to repairs or operating expense, but another can of paint, a brush and four hours' labor painting a partition that has never been painted belong to the Permanent Asset account. How, then, how is the bookkeeper who only sees the continuous flow of bills over his desk to know this unless a method is provided of effecting this information?

Annual depreciation service by means of the engineering appraisal will catch these items; it will furnish the accounting force with the information necessary to set up each year's depreciation charge and placing betterments where they belong.

Appraisal work has become highly specialized; it is therefore natural that men who devote all of their time to the solution of appraisal problems should be better qualified to produce satisfactory results than men who are only occasionally confronted with such tasks. This work coupled with constructive engineering offers to the business world a service of the highest order.

A natural gas well at Pelican Rapids, about 165 miles north of Edmonton, Alberta, became ignited recently and the engineers of the Canadian government were called upon to put it out. Due to the peculiar nature of the flame, the top of the pipe had to be cut off before the actual work of extinguishing the flames began. Steel-jacketed bullets shot from a Lee-Enfield rifle cut the top of the pipe off and permitted the flame to shoot straight up into the air, reaching a height of 75 feet. A 30-foot section of smoke stack was then raised and one end placed over the flame, thus transferring the flame from the end of the pipe to the end of the stack. The other end was lowered close to the ground and held in that position until the gas pipe had cooled off. The lines holding the stack were then released and the stack dropped off the gas pipe, cutting off the supply of gas and extinguishing the flame.—Engineering and Mining Journal-Press.

Glen M. Larson works in the Engineering Department of the Stockland Road Machinery Co., Minneapolis.

Arthur W. Sear has been drafting for the Nordberg Manufacturing Co. in Milwaukee, Wis.

TECHNICALITIES

A PROMISING ENGINEER

First Prof: There's a lad with good stuff in him.

Second Prof: Let's follow him; maybe we can find out where he got it. —Ill. Tech.

WELL?

"This," said the very foolish person as he removed his ear from the very fair person's hairnet, "is what I might term an entangling alliance."—Ill. Tech.

SO SAY ALL OF US

Prisoner: Thank you, Judge, for the sentence.

Judge: Why thank me? I gave you sixty days.

Prisoner: After I heard my lawyer speak I thought you would give me life.—Ill. Tech.

IT LOOKED LIKE IT

A speaker, engaged to lecture in a small town in the Midlands, arrived in the afternoon. The place seemed but poorly provided with bills, and he thought he would find out if people knew anything at all about what was in store for them. Accordingly he entered a grocer's shop.

"Good afternoon," he said to the man behind the counter. "Any entertainment going on here tonight? Anything that will help me to while away an evening?"

The shopkeeper gazed at his interrogator, wiped his hands and then replied, slowly:

"Well, I expect there's goin' to be a lecture. I've been sellin' eggs all day." —London Answers.

"I made a political speech in Carnegie Hall last night!"

"Really! How'd you come out?"

"Limping, but wasting no time."—Lampoon.

WORKING HIS WAY

"Dearest," said the young efficiency engineer, as he opened the front door after saying good-bye to the Queen of the Fairies, "this door swings very stiffly. I am sure that with my engineering training, I can adjust it so that it will not be so hard to open and shut."

"You mind your own business and let that door alone, young feller," came father's voice from the remoter portions of the domicile, "Every time one of you fellers opens and shuts that door it pumps two buckets of cistern water."—Wisconsin Engineer.

E. W.—"I'm so mad at Tom I don't know what to do."

R. S.—"What about?"

E. W.—"He knows so many naughty songs."

R. S.—"Does he sing them to you?"

E. W.—"No, he only whistles the tunes!"

HOW YA GONNA KEEP IT?

"We-el, maybe I could give ye a job as a timekeeper," J. McGarrity, Contractor and Builder, remarked doubtingly to the ne'er-do-well son of his dead friend.

"Why—why—I'm much obliged, but the fact is, the pawnbroker's got my watch," stammered the young prodigal.

IN THE LIBRARY

Sing a song of nuts and bolts,
Of rivet heads and screws;
Entertain yon engineer,
He's got them "Slipstick blues."
—Ill. Tech.

Co'ed: Why do they call it the weeping willow? It doesn't weep, does it?

Ed: No, it used to but one day the fir tree said to it "pine knot."—Gargoyle.

"Oh, Sarah dear," her mother said,
"That man had better go."
"Oh, mother dear, please, not just yet—
He works so doggone slow."
—Punch Bowl.

Father: "What did you do with that last ten dollars I gave you?"

Son: "I bought a dollar's worth of apples and oranges, and spent the rest on dates."—Exchange.

Sam, a colored "slicker," sold Mose a mule. A few days later Mose told Sam the mule was blind.

"What makes yo' tink dat mule is blind?"

"Why, I turned him loose in a field and he ran right into a tree."

"Mose, dat mule ain't blind. He just don't give a damn."—Exchange.

"Oscar, gimme three cigars," ordered Bill Allen as he pitched a quarter across the counter.

"Strong ones, or mild?"

"Gimme the strong ones. The weak ones are always busting in me pocket."

"You've no kick coming," said the polite dispenser as he handed the customer a glass of near beer.

APPLIED CHEMISTRY

KI+2S=KISS: It is a conjugate salt. The reaction takes place more rapidly in the absence of light, and a slight pressure is beneficial. It has a sweet taste and etheral odor. When taken in small quantities it produces a blissful sensation; but in large quantities it has a nauseous effect. It is soluble in distilled moonlight, and is best precipitated in the absence of humanity. The presence of a catalytic agent, for example, Love, increases the speed and temperature of the reaction.

ABSENT-MINDED

First Drunk: "Shay dju know Tom Perkins?"

Second Drunk: "No. Whatsh hish name?"

First Drunk: "Who?"

SOUNDS BAD

Masculine voice: "Please!"

"Aw, come on be a sport."

Feminine voice: "Nope."

"Aw, please, just once."

"POSITIVELY NOT!"

"Aw, gee Mom, all the other fellows are going to wear longies 'n I always have to look like a kid."—Ex.

At Sixteen: "How dare you, sir!"

At Eighteen: "I'm sure I don't know you."

At Twenty: "I don't think we've been introduced, but—"

At Twenty-five: "I'm sure we have some friends in common, so it really doesn't matter."

At Thirty: "Conventions are so foolish, anyway."

At Forty: "My dear man, can you lend me a match?"

—Davenport Weekly.

"I vish that I vas as religious as Alex."

"And vy?"

"He clasps his hands so hard in prayer he can't get them open when the collection box comes around."—Mississippian.

MIXED SMOKING

Conductor: This is a smoking car, madam.

Young Lady: Oh, good! Have you a match?—New York World.

Most lamb is sheep at any price, while venison, on the other hand, is always deer.—Life.

Santa Claus is the only man who pays any attention to silk stockings when there is nothing in them.—Life.

"What is your attitude toward the conventions, Colonel Glubb?"

The Colonel: "Oh, I quit goin' to 'em since prohibition, Miss—you run too big a chance of gettin' poisoned." —Life.

Mother: But what enjoyment do you obtain from smoking?

Daughter: The effect on others.

"So your boy is going to be an architect?"

"Yep. He says he likes to sharpen pencils."

One: "Jeanette swears that she has never been kissed by a man."

Two: "How terrible! I don't blame her for swearing."—Exchange.

SONG OF THE ALMOST ENGINEER

This college is the well-known bunk, I shout and sadly moan. The square guy gets no look-in here, the square deal is unknown. I've burned the so-called midnight oil, o'er drawing and descrip, and making graphs and contour lines, on calc and analyt. I said: "I'll make 'em understand no goofus dumb am I, I'll show them that I know my oil, I'll make Tau Beta Pi." Alack, alas and woe is me, likewise alackaday; the quarter's final grades are out, and there is hell to pay. Instructors, jealous of my brain, have knocked me for a fall, inscribed a record of my shame and hung it on the wall. It was indeed a bitter pill; I wobbled at the knees. The best I made was D in drill, the rest were F's and E's. Tuition cost me thirty plunks; 'twas wasted, every bean, for all I got was seven flunks, and letters from the dean, inviting me to pull my freight, to cancel and withdraw. It seems I got the well-known gate. I'm going to study law.

—Archie McCrady.

THE CONQUEST OF INFINITY

By Carl Luethi

It was a sad day for the inhabitants of Infinity. It was the time of the annual sob festival in honor of the dear dead days before their slavery, when the mortals upon the earth had known nothing of their existence, and they had been free to do as they chose. Consequently, the order of the day was sorrowful reminiscence.

Two parallel lines were seen strolling arm in arm along an asymptote. They were recalling old scenes, and occasionally one or the other would burst into tears as a particularly dear recollection was brought to mind.

"Yes," said one of them, "those were the real days. Take old Euclid, now. He was a good scout. He didn't try to come prying into our affairs. He said we didn't meet, and that was the end of it. These snoopy mathematicians had to follow us up, and now the whole world knows where we meet, and when, and how, and all about it—." The memory was too much for him and he broke down in heart-rending sobs. Just then another couple, the tangent and secant of ninety degrees, joined them and entered the conversation.

"Sure," said the tangent, "and look at us, too. Before some poor simp went and graphed us, we were perfectly happy. We were too big for their use, and so they didn't care anything about us. But as soon as they found out what we were all about—blooy! it was all off. Now we have to work as hard as the sine and the cosine. Can you beat it?"

By this time they had reached the corner where the asymptote they were following met its hyperbola, and here the logarithm of zero was busy directing traffic. Things were quiet just then, so he had a few words to add.

"Why," he complained, "not half an hour ago, one of those fresh variables approached, and when I told him to be on his way, he only grinned, and said he couldn't until the engineer he was working for found the limit he was after. Now wouldn't that get your antilog? And after that—'Whoa, there,'" he yelled, ducking his head as an entire first degree equation whizzed by.

"That was some of Professor Warne's work," he continued as soon as he recovered. "The same thing has happened twice before today, and if that guy keeps on much longer at the rate he's going, I will be worn down to a couple of coincident points before Christmas."

Just then he had to leave in order to untangle a parabola that had become mixed up with its latus rectum, and the two couples walked on, absorbed in their grief, and in the reminiscences of the good old days before their conquest.

"How do you like the new style of long dresses?"

"Oh, I don't mind."

"Why?"

"I've got such a darned good memory."—The Nail Head.

THAT'S SO

The "Road Scholars" and "Probates" seem to outnumber the "Rhodes Scholars" and "Tau Betes."—Wisc. Eng.

I SHOULD SAY NOT!

The frosh who thought that railroads had to use alternating current to operate their swinging signals isn't so much worse than the agric who grounded his radio in a flower pot.—Wisc. Eng.

THE TECHNICAL ASSOCIATION

(Continued from page 12)

ARTICLE X.

Adoption.

Section 1.—At the time of adoption of this constitution, the Technical Association shall take over the funds and property of the Association of Engineering Students, which shall cease to exist. The present Engineering Student Council shall be replaced by the Engineering Student Council committee hereby created. The All-University Council representative shall be elected from and by the students enrolled in the College of Engineering and Architecture. This constitution shall be in effect immediately following its ratification by a majority vote in each of the four departments of the College of Engineering and Architecture and by the School of Chemistry.

The constitution of the Association will be printed in the fall quarter of each year for the purpose of keeping the student body informed of its contents.

The officers of the Technical Commission are:

Philip L. Bergquist, Chairman, Pres. of Am. Soc. of Civil Engs.

Lyle K. McLeland, Sec'y-Treas., Pres. of Am. Ins. Elec. Engs.

Walter C. Bonsall, Pres. of Architects' Society.

Ernest Jewett, Pres. of Chemists' Club.

John A. Anderson, Pres. of Am. Soc. of Mech. Engs.

Professor Rowley and Professor Kerp of the faculty.

A VITAL NEED

(Continued from page 17)

ing what courses they would add to the curriculum. In almost every case public speaking was suggested. The most desirable courses were those which trained the engineer so that his ability would be recognized in other than technical fields. The demand of the present civilization is for men who are leaders of men, and the man who cannot express his ideas and the ideas of his fellowmen is hopelessly lost. He soon becomes a cog in the wheels of industry and his activities are limited to the small realm of specialization.

How can an Engineer appreciate such subjects as "The Greek View of Life" or "Greek Philosophy," when he has but a faint idea of what is happening today? Why sacrifice the opportunities of the present and the possibilities of the future just for the love of the past?

There is a movement to establish Public Speaking in the Engineering College under the direction of Professor Rarig. (It is even hoped that he will do the teaching.) This course would be offered to upper classmen and perhaps we would be allowed to substitute it for some of those mediocre courses which we are now required to take. As it is quite evident that some of our required courses are not nearly so important, we hasten to wish the promoters of this new plan every possible success.

S. B. T.

Herbert O. Halden is in Virginia, Minn., with the Great Northern Power Co.

Mr. R. D. Bostwick, Chemical Engineering 1923, is to be connected with the Oregon Pulp and Paper Co., Salem, Oregon, beginning the first of the year.

BENJAMIN FRANKLIN
1706-1790

Printer, journalist, diplomat, inventor, statesman, philosopher, wit. One of the authors of the Declaration of Independence and the Constitution, author of Poor Richard's Almanack; and one of the most eminent natural philosophers of his time.

But nobody had thought to do it

By bringing electricity down from the clouds over a kite string, it was a simple thing to prove that lightning was nothing more than a tremendous electrical flash.

For centuries before Franklin flew his kite in 1751 philosophers had been speculating about the nature of lightning. With electrified globes and charged bottles, others had evolved the theory that the puny sparks of the laboratory and the stupendous phenomenon of the heavens were related; but Franklin substituted fact for theory — by scientific experiment.

Roaring electrical discharges, man-made lightning as deadly as that from the clouds, are now produced by scientists in the Research Laboratories of the General Electric Company. They are part of experiments which are making it possible to use the power of mountain torrents farther and farther from the great industrial centers.

Electrical machines bearing the mark of the General Electric Company, in use throughout the world, are raising standards of living by doing the work of millions of men.

GENERAL ELECTRIC

MINNESOTA TECHNO-LOG

VOL. IV. NO. 4 FEBRUARY 1924

Published Monthly During the School Year
by the Students of the College of Engineering
and Architecture, School of Chemistry
and School of Mines of
the University of
Minnesota

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

The Chicago Temple
Chicago, Illinois

HOLABIRD & ROCHE,
Architects

Drawn by Hugh Ferriss

© O. E. CO.

"Building a Picture"

HERE the architects envisioned a picture, saw the modern office building in terms of the great art of the Middle Ages—and the result is a demonstration that the utilitarian structure, the modern office build'ng of commerce may be as picturesque as it is practical. Vision, imagination, courage and practical ingenuity in stylistic adaptation have enabled the architects of this country to astonish the world with their achievements of today and their promise of tomorrow.

Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

O T I S   E L E V A T O R   C O M P A N Y

Offices in all Principal Cities of the World

INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

Published and Copyrighted Monthly by

The Engineering Students

of the

University of Minnesota

Main Engineering Building, Minneapolis, Minn.

Subscription $1.50 per year — Twenty-five Cents the Copy

VOLUME IV — FEBRUARY, 1924 — NUMBER 4

TABLE OF CONTENTS

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

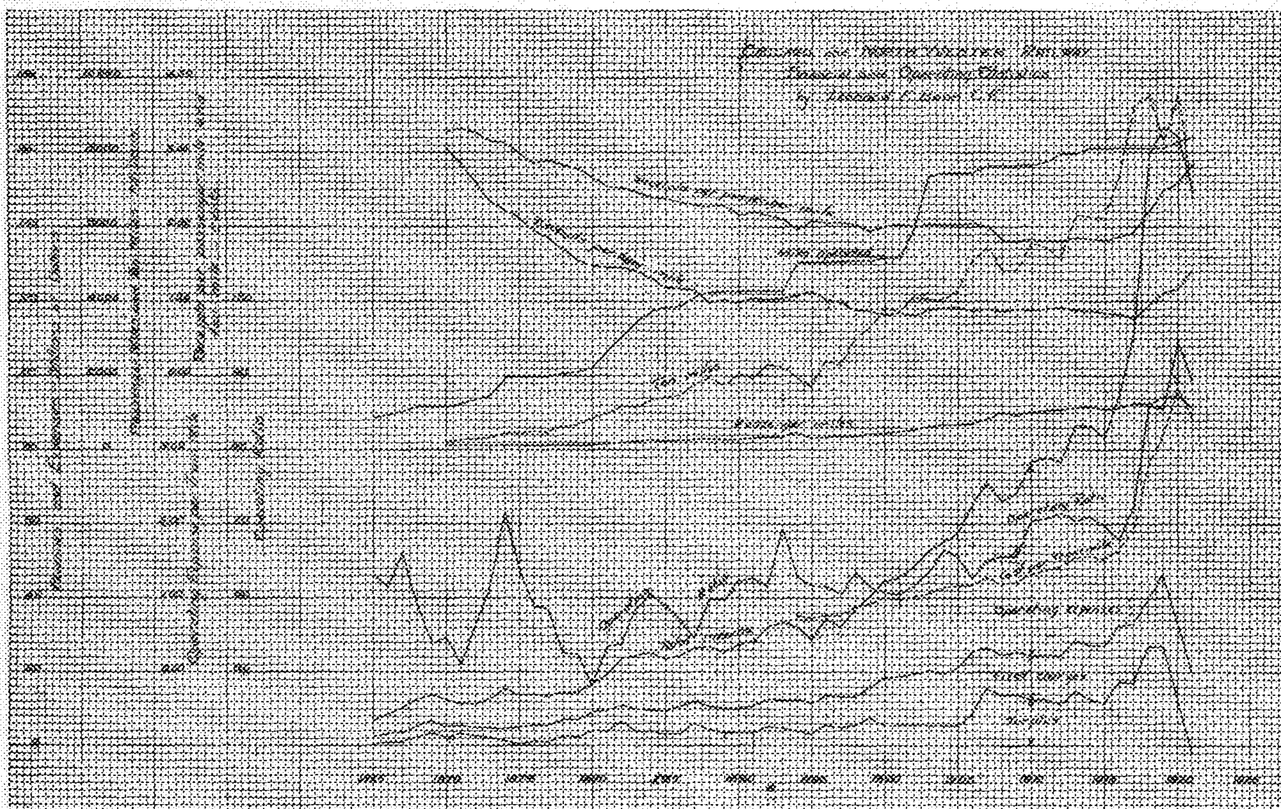
Chairman: Prof. Edwin Kurtz, Iowa State College, Ames, Iowa

The Cornell Civil Engineer
The Transit
Iowa Engineer
Colorado Engineer
Nebraska Blue Print
Penn State Engineer
Sibley Journal of Engineering
Rose Technic
Michigan Technic
Minnesota Techno-Log
Virginia Journal of Engineering
Ohio State Engineer
The Towne Scientific Journal
Wisconsin Engineer
Illinois Technograph
Tech. Engineering News
Kansas State Engineer
Princeton E. A. News Letter
Kansas Engineer

MINNESOTA TECHNO-LOG

University of Minnesota

VOLUME IV FEBRUARY, 1924 NUMBER 4



THE NORTHWESTERN CARRIES ON

Railroad Has a Deficit for the First Time in History---Curves Show the Effect of Recent Conditions

By Leonard F. Boon

Professor in Civil Engineering, University of Minnesota

This is the first of a series of short articles on the railways of the United States.—EDITOR.

THE data from which these curves were plotted were obtained from the following sources:

1865 to 1887 were taken from Poor's Manual of Railroads;

1874 to 1886 from Wellington's Economic Theory of Railway Location;

1888 to 1921 from the statistical reports of the Interstate Commerce Commission.

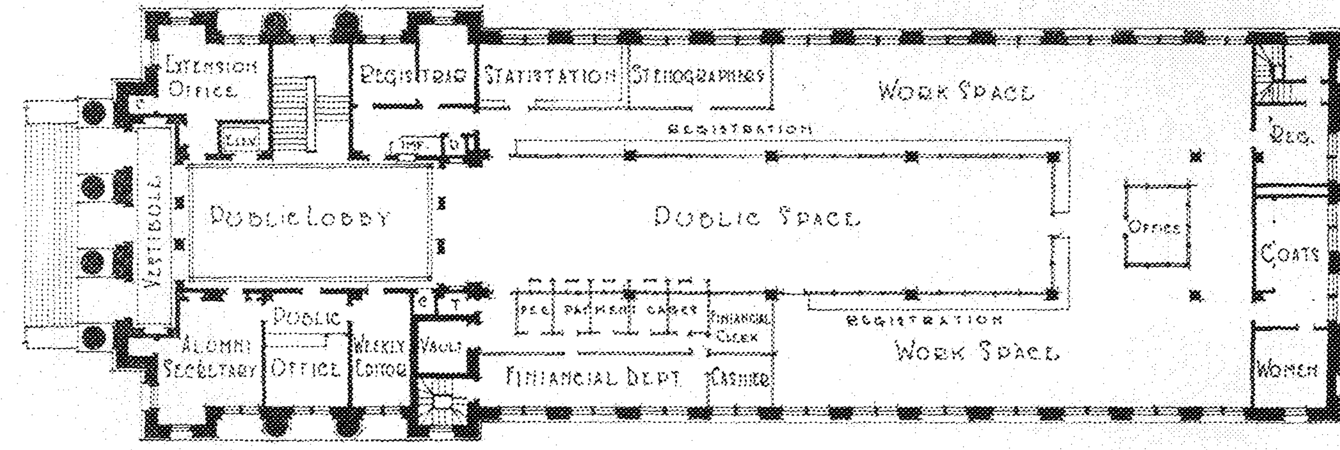
From 1888 to 1916 the I. C. C. figures are for the year ending June 30th, while from 1917 to 1921, the figures are for the year ending December 31st. Since the figures are taken from various sources and for various dates, there are some discrepancies and overlaps. These are small and do not seriously affect the curves.

The total income includes operating revenues and income from all other sources such as income from stocks held in the treasury. The fixed charges include interest on funded debts and taxes. The ordinate between the base line and first curve represents the surplus for each year, between the first and second curves shows the fixed charges, and that between the second curve and the curve showing total income gives the operating expenses. Note the gradual rise in total income up to 1915, the rapid rise to 1919 and the falling off in 1920 and 1921. The panic of 1873 had little effect, while the effect of the panic of 1893 was not fully felt until 1895. Operating expenses have increased more rapidly than the income, and this is very noticeable during the war. Fixed charges have been fairly uniform throughout the period, gradually increasing as the capitalization increased.

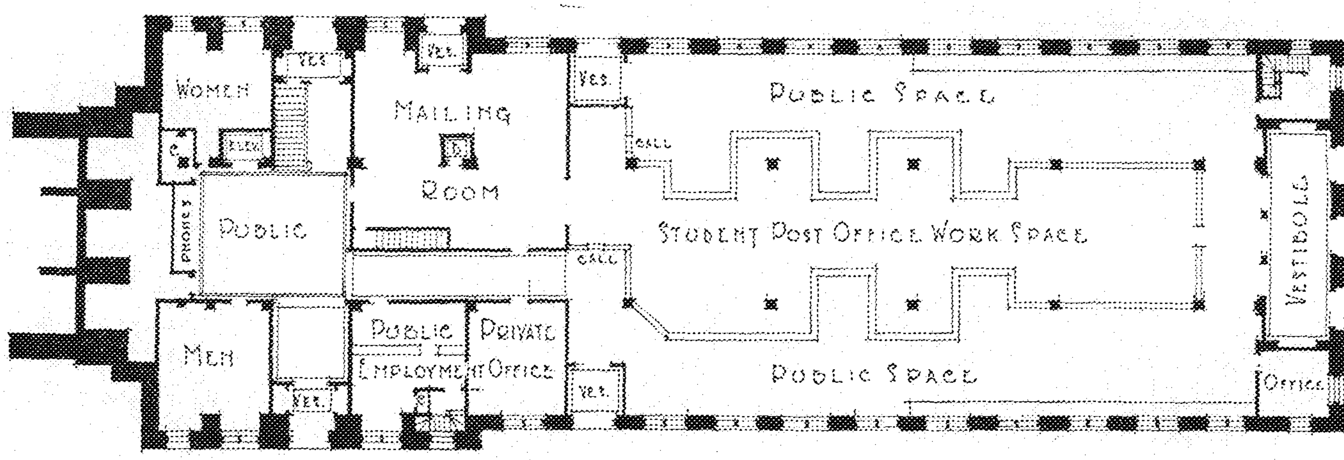
The cost of operation is shown in the "Cost per train mile," which rises from \$.73 in 1895 to \$3.84 in 1920. This is caused by the rise in wages and cost of material.

The operating ratio is the ratio between operating revenues and operating expenses. It should not be

(Continued on page 30)



First Floor Plan
Scale 1/32" = 1'-0"



Basement Plan
Scale 1/32" = 1'-0"

Administration Building University of Minnesota
C. H. Johnston, Architect Saint Paul

ADMINISTRATION BUILDING NEXT

All University Offices To Be Housed Under One Roof---Construction Will Start This Spring

By Horace W. Tousley, Arch., Ex. '24

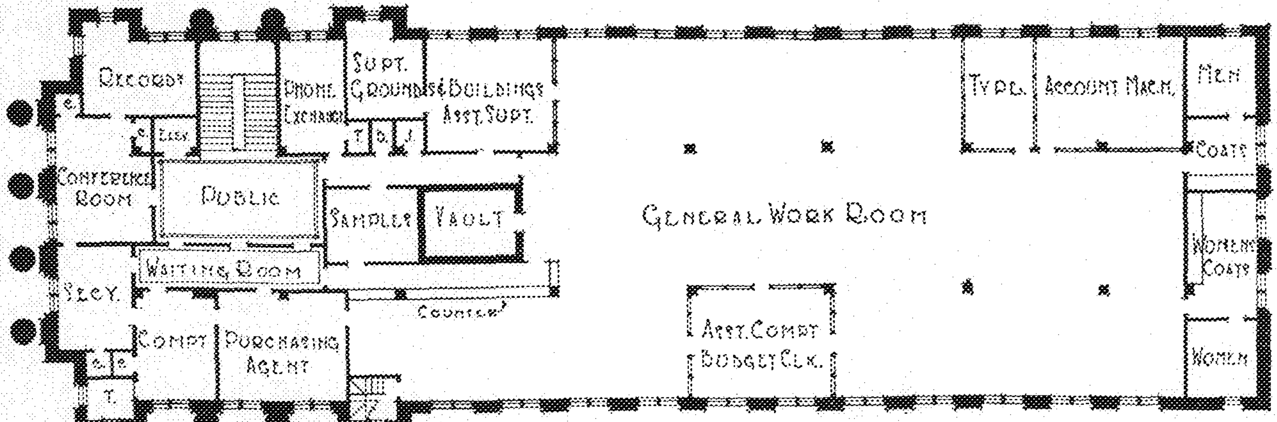
We are glad to have secured the assistance of Mr. Tousley in the writing of this article in view of the fact that he was formerly Associate Editor of The Techno-Log and is now employed by Mr. C. H. Johnston, State Architect, Saint Paul, in whose office the plans are in preparation.—Editor.

UNLESS plans go astray construction will start within sixty days on the new $400,000 Administration building unit of the University of Minnesota's ten-million-dollar building program. According to the office of Mr. C. H. Johnston, State Architect, St. Paul, plans will be in the hands of prospective bidders the last of February, which means that contracts will be let and excavation started in another thirty days.

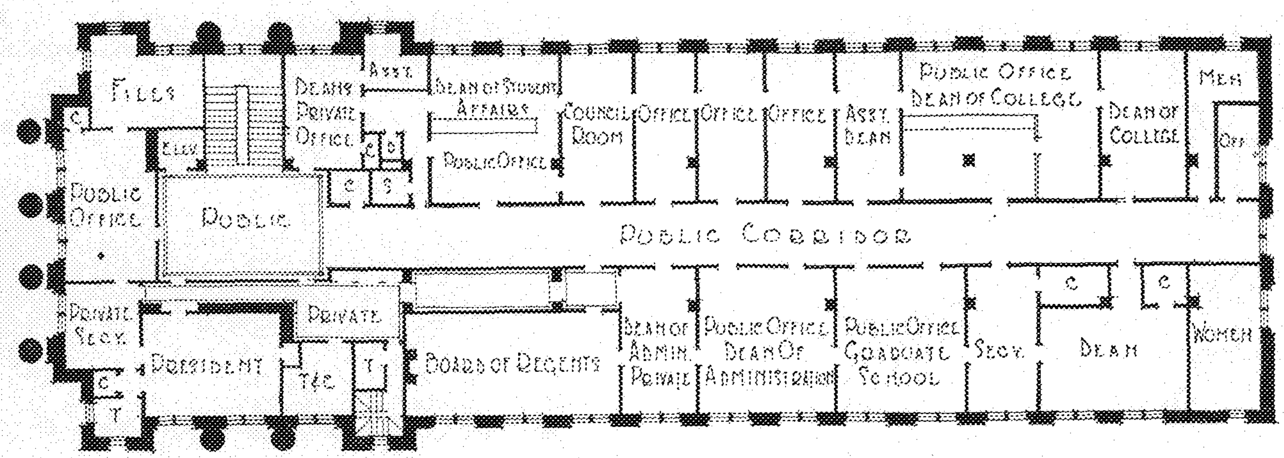
Following the approval, the first part of January, of final office arrangements by the various administrative officials concerned, work was started on final working drawings by the state architect's force and they are nearing completion. These plans show the building to be seventy by two hundred and twenty feet in its greatest dimensions, and practically six stories high. The six floors include the basement, first, second and third floors which are apparent from the perspective and then the roof house and attic floors in a portion of the building which is not readily visible from a short distance.

In style and material the new building, which will be located sixty feet north of the new library building but across The Mall, will conform in the main with its predecessors, the Chemistry and Library buildings. The Administration building will be the first structure on the east side of The Mall and when completed will define The Mall in the minds of the laymen. The west front will have a four-column portico which will be a replica of the Chemistry and Library porches.

The rear of the building will face the Engineering building, but the rear facade will not be particularly uninviting, for the main entrance to the postoffice



THIRD FLOOR PLAN
Scale 1/32" = 1'0"



SECOND FLOOR PLAN
Scale 1/32" = 1'0"

ADMINISTRATION BUILDING UNIVERSITY OF MINNESOTA
C.H. JOHNSTON, ARCHITECT SAINT PAUL

will be from the east. Reference to the basement plan on the opposite page will show three east entrances to this "center of student life." Access is also gained to the postoffice by north and south entrances or from the main public lobby to the west. Immediately inside the postoffice at side of the entrance will be an office with a Dutch door which will be convenient for ticket sales and what not. Writing desks along the walls and two call windows will aid the students in the postoffice. A general mailing room with dumb waiter and mail chutes from the upper floors will complete the postal arrangements.

Opening off the basement lobby will be the offices of the University employment bureau, public elevator and toilet facilities for men and women. Four public telephone booths will add to the conveniences. Three stairways lead from the basement to the first floor. One starting from the employment office connects the official departments of the University in a private way. A stair of similar nature will be found in the northeast corner which leads to the registrar's office. There will be, in addition to these, one great public stairway of gray Tennessee marble and wrought iron.

Entrance to the first floor may either be from this stair or from the front through the great portico into a public vestibule and lobby. For the stranger there is the information desk at the left. The graduate will find the alumni suite to the right, while across the lobby is the extension division public office. The business of matriculation, payment of fees and general registration occupies the greater part of the first floor as a study of the plan will show.

As one bent on business, or the visitor, enters the Administration building, they will be impressed by the dignity and stability of the University, which is expressed in the design of the great public lobby, the walls and floors of which will be executed in marble. Gray Tennessee marble will make up the body of the floor, which will be divided and ornamented with patterns and divisions of Rouge Acajou, while the walls will be of Tracon marble on the first floor, and the lobbies of the other floors will be finished in Caen stone to imitate the real Tracon.

On the second floor are located the offices of the president, the deans, and the Board of Regents. Two features of the Regents' quarters will be the wainscot of Alps green marble with a Belgian black sub-base and a great fireplace at the west end of the room. Ornamental plaster will aid in the decoration of the governing board's room as well as the president's room. A splendid quartered oak paneled wainscot occurs in his office. Quarters for the general business of the University are located on the

(Continued on page 26)

THE CORRUGATED METAL CULVERT

Type of Building and the Material Used Make the Structure Stand Up Under All Tests

By J. D. Frazer, '09

THE rapid and unprecedented growth in the use of the corrugated metal culvert has given rise to some speculation as to the probable life of this type of structure. Up until the last few years it has been viewed by the Engineering Profession as more or less of a temporary structure. Two reasons could probably be ascribed for this fact; first, the corrugated culvert is a comparatively light structure; second, the ease with which the manufacture of this product might be taken up, tempted some unscrupulous manufacturers into this field and resulted in an inferior product. Recent investigations, however, have developed the fact that a good corrugated metal culvert is not a temporary structure and when made from the proper materials and when installed in the proper manner it may be expected to give service equal to the service given by most any type of road.

Insofar as it has been possible to determine, the first corrugated culvert manufactured in the United States was installed by the inventor, Mr. Jas. H. Watson, in 1896. The culvert went into service under a highway near Crawfordsville, Ind. This culvert was dug out recently and found to be in good condition in spite of its twenty-eight years of service. There are many interesting facts in connection with this installation which it would be well to recite.

In the first place, the material in this culvert was a sandwich-like structure—layers of common steel between thin layers of iron. This product was known as "puddled top and bottom." It was manufactured for a limited time. The top and bottom were a pure puddled iron. The core or center was an impure Bessemer steel. At the time this culvert was installed galvanizing was not used extensively and this culvert was put into the ground with only a coat of paint for protection. Evidently the life of this structure might be ascribed to the layers of puddled iron which were not readily attacked by the rusting agents in the soil.

Indiana Is Home of Metal Culvert

The discovery of this culvert with the definite determination of its life has led to further investigation in most every state of the Union under railways and highways. For instance, an exhaustive and complete investigation was made in the State of Indiana, the home of the corrugated metal culvert. Hundreds of culverts with the service life of from 20 to 25 years were discovered. Questionnaires were addressed to various highway engineers in that state and in no instance was it found that corrugated metal culverts, made from rust-resisting materials and properly installed, had failed.

The general utility of the corrugated metal culvert has for some time been recognized. Corrugating a metal increases its strength about twenty-nine times. Investigations carried on by Mr. Fowler, a nationally known consulting engineer, led to the deduction that a corrugated metal culvert of standard gauge when supplied with an earth covering equal to its own diameter is uncrushable. The large number of installations which have been made under heavy fills and under extraordinary heavy and exacting conditions of traffic have demonstrated the fact, from a practical standpoint, that a corrugated culvert of proper gauge is sufficiently strong for all requirements.

Elasticity is also an element of vital importance in a culvert structure. The freezing and heaving of the soil subjects a culvert at times to tremendous strains. A rigid culvert, under these circumstances, oftentimes cracks and goes to pieces. It is found also that in many instances a culvert is frozen solid when full of water. The expansion, under these conditions, naturally demands a certain amount of elasticity in a culvert structure if it is to stand up satisfactorily. The impact of traffic, particularly where a culvert is installed with relatively small head room, also presents a requirement of elasticity. Under all of these conditions a corrugated metal culvert has been found to give an exceptionally good account of itself and the splendid service life which this type of structure has rendered is undoubtedly due to a considerable extent to the elasticity which the corrugated metal culvert possesses.

Resists Rust

The last remaining requirement for permanence of a metal culvert is that its material resists rust. Since the investigations above referred to have demonstrated beyond any question of a doubt the fact that corrugated metal culverts have actually given satisfaction it would seem that this requirement also has been met. It is true that there has been considerable argument and difference of opinion upon what particular metal or metals it is best to use. Man-made tests have been initiated and carried through. Many wrong deductions have been arrived at. Improper comparisons have been drawn with a tendency to confuse the user of corrugated metal culverts. The test of time, however, is the real and the convincing test and when installations, such as the one described in the foregoing, are brought to light and studied, deductions may be drawn of an accurate nature upon which an intelligent decision may be reached.

There is probably but one obstacle which stands in the way of the general recognition of the corrugated iron culvert as a permanent structure. That obstruction is a more or less justified prejudice which has been built up. Like all industries during their formation, there have been a host of abuses. Culverts have been sold with too light a gauge material. Improper construction methods have been employed. Little study was given during the early history of the industry to the question of the adaptability of this particular type of structure. Some manufacturers resorted to the use of inferior materials; in some cases even using mill seconds and wastures. Some of these practices were due to ignorance and some to wilful deception. There has been a growing tendency, however, to wipe out these conditions and practices. Much has been accomplished through the medium of carefully prepared and rigidly adhered to specifications. The manu-

(Continued on page 23)

HISTORY OF ST. PATRICK'S DAY

Myth Is Shattered by Matter of Fact Explanation---
A. C. E. Convention To Be Held Here

THE Association of Collegiate Engineers will hold its annual convention at Minnesota for the first time since its inception at the University of Missouri. Mr. Philip Bergquist, who was elected National Vice President, is in charge of the general arrangements for the convention. A short history of the association will not be amiss.

"Let profs do their worst; there are moments of joy;
Bright dreams of the past that they cannot destroy;
Which came in the night time of Flunkers' despair,
And bring back the features St. Pat used to wear."

The celebration in honor of St. Patrick began with the discovery of the Blarney stone during the excavation for the Engineering Building Annex in the year 1903. This stone was found to be covered with ancient figures resembling the hieroglyphics of old. For a long time these obvious purveyors of some important text were unread. However, the strange writings were soon translated after some concentration on the part of the seniors, and the translation given to the world. These men announced that the results of their investigations into the ancient writings of the past ages had given them the knowledge whereby they found the Blarney stone to convey the fact that "Erin go Bragh" meant that "St. Patrick was an Engineer."

Such is tradition. As a matter of fact, the whole thing started from a discussion in the senior electrical design room one night. A History of St. Pat had been published by some historian and was causing comment throughout the country. That night an Engineer asked the question: "Who was St. Patrick?" The immediate reply was, "An Engineer, of course." It was decided at once that March 17th should be a holiday, and the following resolution was written:

"Whereas, in the ranks of the Engineering Department there are many of noble birth and Irish blood, and

Whereas, the ancestors of many of our illustrious students came from Erin's Isle, and

Whereas, St. Patrick was an Engineer,

Therefore be it resolved, that the Engineering Department take a holiday and attend the morning prayer-meeting in a body."

On the morning of St. Patrick's Day a large group of Engineers attended the **prayer-meeting** in a body and held a later meeting in the general library, where they dedicated themselves to the service of their patron saint. It is said that it was a most imposing and impressive scene. After this they followed the band about town, singing Irish songs and having a splendid time in general. It was not long before many of the colleges of the country caught the spirit of St. Pat.

The first national convention was held at the University of Missouri on Dec. 5, 1919. A conference representing eleven schools from seven states assembled. They organized the Guard of St. Patrick, adopted the Knight's pin, drew up a Constitution and By-laws providing for the securing of officers, and held an election. Since then a national convention has met each year and many chapters have been added. The following chapters have expressed their intentions of sending two delegates each:

University of Oklahoma
Missouri School of Mines
University of Tennessee
Washington University
Oklahoma A. & M. College
Iowa State College
University of Arkansas
University of Missouri
Johns Hopkins University
University of Nebraska

Philip Bergquist, V. Pres. of A. C. E.

The Technical Association of the University of Minnesota is a chapter of the Association of Collegiate Engineers. Each student in the College of Engineering and Architecture and the School of Chemistry is a member of the association. The delegates who will represent Minnesota at this convention will be Stewart Willson, Chairman of Engineers' Day last year, the chairman-elect this year, and Philip Bergquist, National Vice President.

The following chairmen have been appointed and at present are hard at work:

John Anderson, Chairman of the House Committee

Lyle McLeland, Chairman of the Entertainment Committee

Wallace Bonsall, Chairman of the Transportation Committee

Ernest Jewett, Chairman of the Reception Committee

Clyde Lighter, Chairman of the Publicity Committee

On Thursday night at 8 o'clock, February 14, an all-Engineering Smoker will be given. The entire student and faculty body will be present. "Al" Greene is in charge of the smoker and he assures you that an evening full of fun and entertainment will climax the first day's session.

(Continued on page 28)

THE VEE-TYPE CADILLAC ENGINE

Bold Defiance of the Common Notion That Crankpins Must Be In Line

By Edward Nickerson, E. E. '24

IT HAS been rumored for some time that the Cadillac Motor Car Company was developing a new model. Of course, the new car would have four-wheel brakes, but it was also rumored that the engine would be radically changed. Many said that the new engine would be of the straight-eight type.

The new model has appeared. The engine, although it is not of the straight-eight type, is radically different in certain important details from previous Cadillac engines and other conventional eight-cylinder engines.

The most striking feature of the new engine is that no two of its crankpins are in line. Hitherto, it has been an axiom that an automobile engine should have an even number of crankpins, and that these crankpins should be so arranged that the end ones should be in line with each other, the next ones in from the end ones should be in line with each other, and so on. By this scheme, if the pistons were made equal in weight, the connecting rods equal in weight and similar in weight distribution, and the cylinders parallel with their axes all in the same plane and symmetrically spaced, the angular momentum of the reciprocating parts about a transverse axis would, if the cranks were of equal eccentricity, be constant and equal to zero. If, in addition, there were at least four crankpins, and the two or more crankpin axes were equidistant elements of a cylinder having the axis of the main journals for its axis, the kinetic reactions of the reciprocating parts would, at least approximately, and in some cases almost exactly, form at all times a system of forces in equilibrium. Hence, if the rotating parts were properly balanced, there would be little tendency (in some cases practically none) to vibration.

When there were four crankpins, as in the four-cylinder engine and the ordinary Vee-type eight-cylinder engine, it was found that there was a slight tendency toward vibration, due to the fact that the angularity of the connecting rods caused the velocities of the ascending and descending pistons to be unequal at all instants when the plane of the crankpin axes was in an inclined position.

From figure 1, which illustrates the operation of a one-cylinder engine, it will be seen that when the crank is ninety degrees from dead center the piston is slightly below mid-stroke. Now, in a four-cylinder engine, when one crankpin is ninety degrees from a dead-center position, every crankpin is ninety degrees from a dead-center position, and likewise, when one crankpin is at its top or bottom dead-center position, one other crankpin will be at the corresponding point in its orbit, and the other two will be at the opposite dead-center position. Hence the center of gravity of all the pistons is alternately where it would be if they were all exactly at mid-stroke and a little lower. When the center of mass of a system of bodies has such a reciprocating motion, the reaction of their inertia is a pulsating force which tends to produce vibration. In an ordinary eight-cylinder, the forces of unbalance of the two component four-cylinder engines, acting in different directions, do not exactly neutralize each other, and the engine as a whole is not in true running balance.

In the new Cadillac engine, the double-frequency harmonic components in the motions of the pistons, which produce the unbalance in ordinary fours and eights, are themselves balanced. The primary harmonics (i. e., the simple motions which the pistons are assumed to have when the effects of connecting-rod angularity are neglected) produce a powerful reaction tending to produce vibration, but this reaction can be accurately compensated by the reactions of suitably mounted weights on the crankshaft. Two such weights are necessary in theory, but four

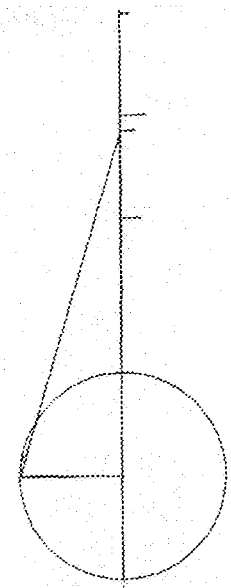


Fig. 1

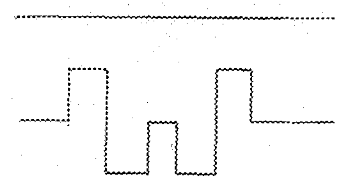


Fig 2 Crankshaft of ordinary eight

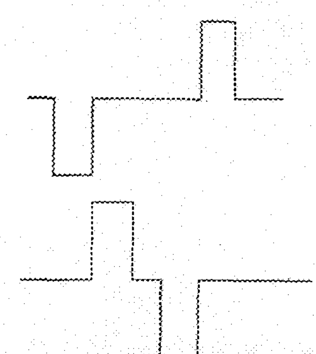


Fig 3 Cadillac Crankshaft.

so placed as to be equivalent in their combined effect to the two are found to produce better local balance, reducing stresses. Of course the effects of the rotary and reciprocatory motions of the crankshaft and connecting rods have to be considered in the selection and location of the counterweights. By using the novel form of crankshaft shown in Fig. 3, and attaching suitable counterweights, the Cadillac engineers have produced a Vee-type eight-cylinder automobile engine which runs with virtually no vibration.

I admire this innovation not only for the ingenuity shown and for the good results obtained, but also for the bold defiance of the common notion that the crankpins must be arranged in the rather definite manner mentioned earlier in this paper. It is certain that the new Cadillac engine is not the only possible type of engine defying this convention and yet having running balance. Of course, it is yet to

(Continued on page 30)

ALUMNI SHOW INTEREST IN COLLEGE

Suggestions Made for Course of Study and Type of Electives--- Five Years Work Recommended

By Albert W. Morse, E. E. '25

HIS University never ceases to be a subject of interest to the graduate of the College of Engineering. Through ensuing years of field practice and routine office work, his thoughts ever turn back to the days when his technical mechanics book was his inseparable companion.

Undergraduates frequenting the city hall of Minneapolis invariably receive a cordial greeting from the alumni employed there in the engineering departments. One of those occupying positions of great responsibility is Jay C. Vincent, E. E. '03, electrical and mechanical engineer.

Himself a brilliant student in his undergraduate days and a notable success in his chosen field, Mr. Vincent may well be regarded as a worthy example by those now in college. The remarkable thing about his habits while at the University was that he made all his time pay dividends. Scholastically, he ranked among the best, and his spare time was devoted to original research. In recognition of his accomplishments, he was elected to membership in Sigma Xi, national honorary scientific fraternity.

It was while Mr. Vincent was at the University that C. H. Chalmers, Minneapolis manufacturer, conducted a "Dynamo Electric Machinery" contest. A thesis on "An Experimental, Single Phase, Series Motor," together with the motor itself, which Mr. Vincent designed, won the prize. This was the first of a large number of design problems which he successfully solved.

With his experience as a student mellowed by twenty-one years of practical work, Mr. Vincent has acquired a reliable perspective of the engineering profession, and understands the viewpoints of men engaged in other lines of work. To the question, "What field should a beginning student enter?" he replies, "The particular course of study which a student should take up depends almost entirely upon his personal desires and inherent ability, and such a course can be determined by self-analysis with reference to the various branches of the profession in which he seeks employment."

Verne F. Curtis

That the personal desires of a student should largely govern his choice of a life work is unquestionably true, and this admonition of Mr. Vincent does perhaps receive considerable attention. Concerning inherent ability, some persons may believe that ability in any line may be developed by personal application, but there are innumerable cases where men have failed regardless of their training. And the question of self-analysis may be booed by some persons, but the fact remains that there are those who have not the ability to analyze themselves.

Jay C. Vincent

Mr. Vincent spent a large amount of time during vacations in practical work, and his employment with the Electric Machinery Co. was the equivalent of two and a half years of service when he graduated. So all through his college course he combined the practical with the theoretical. He understood what he was studying about, and he did not rely wholly upon memory work in mastering his class assignments.

It was his observation of other students trying vainly to understand book-talk that prompts Mr. Vincent to say, "I think that one of the main faults with the mechanical and electrical courses is the lack of practical work before graduation, and I am in favor of at least one year of shop or field work in the particular line which a man intends to take up after leaving college. Such an apprenticeship should be taken before the junior year, thus visualizing to the student the subjects which he will study in the junior and senior years. This is in line with the training required in the medical and dental professions."

Promotion on the first of this month to the position of supervisor of the garbage department marks another step in the rapid advancement which Verne F. Curtis, M. E. '22, has had since he entered the employment of the engineering department immediately after graduation. He formerly was assistant mechanical engineer, and until his last promotion held the position of assistant to the supervising engineer of the crematory department. In the latter

(Continued on page 28)

ALUMNI NEWS

In the hope that we can locate a number of "lost" engineers, we will publish a list of names in each issue of the Techno-Log. These are names of men who have changed their mail address and of whom we have no location record. The Techno-Log and the dean's office are desirous of keeping a complete and up-to-date record of our alumni. If you have any knowledge concerning these men you are urged to send it to the alumni editor of the Techno-Log.

—ELECTRICALS
Lemuel J. Dunlap
Karl D. Fastenau
Walter J. Finke
Charles K. Hillman
Frederick W. Hooen
Amos D. Houlton
Conrad D. Hovden
Gates E. Hunt
Melton B. Huntoon
Arthur R. Jacobs
Ray R. Phelps
Robert S. Prentice
Frank E. Reidhead
John J. Rezab
William F. H. Schildt
William P. Schow
Donald D. Shepard
Ernest E. Skytte
Joseph H. Soulek
Will V. Stinson
Robert B. Taplin
George R. Jones
Jake M. Levin
Donald Loye
Dartt H. Lyford
Elwood M. MacKusick
Nathaniel Mori
Frederick E. Murrish
Mortimer Myers
Carl H. Nelson
Richard H. Olson

We hope the alumni will continue to send in information concerning any Minnesota men they are acquainted with. This will greatly facilitate and aid the alumni department in making up a complete alumni directory.

Through the publication of the "Lost" column, the following men have been located:

C. D. Jensen, C. E. '21, is with the Northern States Power Company, St. Croix Falls, Wis. At present he is doing some drafting work for the company and can be located in Zelner's office.

Frederick T. Paul, C. E. '09, has been located as Assistant Engineer in the City Engineering office in Minneapolis. Fred was in charge of construction on the new Franklin Avenue Bridge. (It's funny how he got "lost.")

Geo. W. Jevne, C. E. '10, was last heard from in Arizona.

George W. Bleecher, E. E. '16, is working as estimating engineer for the Sterling Electric Company of Minneapolis. He is a member of the Minneapolis Engineers' Club.

Clarence M. Rader, C. E. '17, is making oil for the Midwest Refining Company at Casper, Wyoming.

Oliver A. Stoutland, C. E. '22, is in the estimating department of the Minneapolis Steel & Machinery Company.

MINERS

Robert E. Ainsworth, M. '20, has forsaken mining for highway engineering. After working with the Old Dominion Company of Arizona, he went into the planning department of the Minnesota State Highway and now we find him with the city engineering department of Los Angeles, California.

Ralph C. Johnson, M. '22, who had the misfortune to lose an arm in an accident at Babbitt, Minnesota, while working for the Mesabi Iron Company, six months ago, has returned to Minneapolis. At present he is contemplating registration in the School of Business.

Alfred C. Bierman, M. '14, recently announced the establishment of the firm of Bierman and Osborne, consulting engineers and geologists at Los Angeles, California. Since his graduation from the School of Mines, Mr. Bierman's profession has taken him to Costa Rica, Central America; Tampico, Mexico, and Colombia, South America.

B. W. Gandrud, M. '21, who, until recently, was employed by the Fairview Fluorspar and Lead Company, has secured a position with the United States Bureau of Mines at the University of Alabama.

Guy Ingersoll, M. '18, has left his position on the faculty of the Michigan College of Mines to work for the Ray Consolidated Copper Company at Ray, Arizona.

Roswell W. Prouty, M. '12, has gone into the employ of the Portland Cement Company at Riverside, California. Since receiving his degree from Minnesota, Mr. Prouty has spent all of his time in Arizona, actively engaged in mining.

In the publication of the "Transactions of the American Institute of Mining and Metallurgical Engineers" for the last half of 1923, we notice an article on "Mining Methods at Bawdwin Mine," by **A. B. Calhoun,** a graduate of the School of Mines in 1905. Mr. Calhoun is the mine manager at Bawdwin, Burma, for the Burma Corporation, Ltd. These mines are located fifty miles west of the Province of Yunnan, China, and 170 miles northeast of Mandalay. Mr. Calhoun states that the Chinese worked the deposits at Bawdwin, which contain silver, lead and zinc, as far back as 1412 A. D. They were abandoned in 1868, and in 1891 a party of Europeans were attracted by the slag dumps that the Chinese had discarded after removing the silver. These dumps assayed forty per cent lead. The mines at Bawdwin have been developed with great success until today they are considered to comprise one of the largest high-grade silver-lead-zinc properties in the world.

CIVILS

R. L. Burke, C. E. '05, is living at 823 East First street, Duluth, Minnesota. He is a partner in the firm of Bowe and Burke. The firm is operating mines on the Mesaba Range.

John L. Burt, C. E. '90, is one of the old-timers who has strayed into foreign fields. Mr. Burt is a biscuit manufacturer, the firm being Cia Palletera Nacional, located at Apatardo 345 Guadalajara, Jalisco, Mexico. His home address is 526 Calle de Monzano, Guadalajara.

H. N. Bruce, B. S. '16, C. E. '17, is with the A. M. Chesher Printing Company of 608 First avenue north, Minneapolis. He was formerly with the Minneapolis Board of Park Commissioners. Mr. Bruce is living at 5450 11th avenue south. He is a member of Theta Xi, Tau Beta Pi, Alpha Chi and the Minneapolis Engineers Club.

E. R. Boyce, C. E. '17, is employed by Olmsted County as highway engineer. Since graduation he has held positions with the Strong and Scott Manufacturing Company, Second Lieutenant in the Engineers' Corps of the U. S. Army, and assistant engineer of Polk county, Minnesota. Mr. Boyce is living at Rochester, Minn.

F. P. Bowen, C. E. '06, can be located at 3738 38th avenue southwest, Seattle, Wash. He is employed by the city engineer of Seattle as a structural draftsman. Mr. Bowen was formerly a topographer for the Great Northern railway. He is a member of the American Association of Engineers.

O. M. Bolme, C. E. '10, has his habitation at 15 Park Row, New York City. He is employed as designer and estimator for the Robins Conveyor Belt Co. During his professional career he has been connected with Chicago, Milwaukee & St. Paul railway, designing reinforced concrete; American Bridge Co., on shop details; and the United States Shipbuilding Corporation, in charge of designing. Mr. Bolme is a member of the Western Society of Engineers, American Association of Engineers, Sigma Xi and Tau Beta Pi.

J. A. Bohland, C. E. '95, is bridge engineer for the Great Northern railway. He has been with the Gillett-Herzog Co. and the Chicago, Rock Island and Pacific railway. Mr. Bohland is living at 1233 Montreal avenue, St. Paul, Minn. He is a member of the St. Paul Engineering Society, American Railway Bridge and Building Association, and American Society for Testing Materials.

H. F. Blomquist, C. E. '07, is living at 1837 Seventh street east, Cedar Rapids, Iowa. He is employed by that city as superintendent of the city water works. During his career Mr. Blomquist has been city engineer of New Ulm, Minn.; city engineer of Mankato, Minn.; and assistant engineer of the St. Paul city water works. He is a member of the St. Paul Engineering Society, Cedar Rapids Society of Engineers and Architects, Cedar Rapids Chamber of Commerce and the Cedar Rapids Rotary Club.

Edward J. Soshnik, C. E. '22, who has been seeing the U. S. A. for the past twelve months, while pursuing engineering as a sideline, has gone into business for himself as structural engineer in Minneapolis, and is designing the iron towers for the radio aerials that are to be constructed on the new electrical engineering building at the University.

James Darrell, C. E. '23, and Miss Elizabeth Bedford of Byron, were married on November 1, and are living at St. Croix Falls, where Mr. Darrell is working for the Northern States Power company. Beryl Darrell ('23) came from Anderson, Ind., where she is Y. W. C. A. secretary, to attend the wedding.

Harry Abramson, C. E. '23, has been spending a three weeks' vacation in Minneapolis. He visited the University Jan. 10, stopping in to see Prof. Zelner and some of the boys. Harry is doing research work, on classification of soils, for the Illinois Highway Department. Mail address, 100 East Washington, Springfield, Illinois.

H. A. Barber, C. E. '21, is employed by the Southern California Edison Co. since January, 1923. His official capacity is camp engineer of Camp 62 located at Big Creek, California. Previous to this time he was employed as engineer on municipal work for W. L. Fahey of Spencer, Iowa.

Francis A. Dever, C. E. '20, is employed with the Pennsylvania railroad in charge of the construction of a yard at Weirton, W. Va.

N. S. Anderson, C. E. '22, has been with the Schuett Meier Structural Engineering Co. since March, 1923. He is designing reinforced concrete. Previous to this time he was with the Concrete Steel Co., doing the same kind of work. Mr. Anderson worked on the designing of the Thorp building and drew up the foundation plans and column design and schedules of the Dowling school. Mr. Anderson was taken sick with scarlet fever last December and was forced to spend 17 days in the hospital, being discharged the 8th of January. During his "vacation," he visited the University and, of course, Prof. Zelner. While at school Mr. Anderson was a member of the A. A. E. Address mail to 3136 First Avenue South, Minneapolis.

A. E. Lux, C. E. '16, is in the grocery business with his father, The John W. Lux Company. The establishment is located in St. Paul.

Ed Adams, C. E. '21, gives his address as R. R. No. 2, Linden Hills station, Minneapolis, Minn. Ed is in the contracting business for himself and has his office in the Essex building.

Rutcher Skagerberg, B. S. '15, C. E. '16, is with the American Blower Company, of Detroit, Michigan. He is visiting some of the leading paper mills of the United States and Canada, doing special work in drying, fuel conservation, conditioning, and heating in the mills. Mr. Skagerberg was married in September, 1922, and now has a son, John Paul, five months old. While in school Mr. Skagerberg was active in many organizations. He was manager of the Glee Club and manager of the old Minnesota Engineer.

Professor Parcel, through the Extension Department, is teaching a course in Advanced Structural Design which several Minnesota alumni are attending. Some men in the Graduate School are also taking the course. The class meets every Monday evening in the Main Engineering Building. The subject of the course, as its name implies, is a study of advanced and secondary stresses.

Among those taking the course are the following men: **G. C. Staehle**, C. E. '20, consulting engineer; **A. C. Larson**, C. E. '20, assistant to Staehle; **J. B. Purdy**, C. E. '20, chief engineer of the Minneapolis branch of the Truscon Steel Co.; **L. T. Wiley**, C. E. '20, and **C. E. Eckburg**, C. E. '15, of the bridge department of the N. P. Ry.; **C. F. Moore**, C. E. '20, of the Minneapolis Steel and Machinery Co.; **J. F. Keeler**, C. E. '22; **E. W. Seeman**, C. E. '20, and **E. J. Soshnik**, C. E. '22.

ARCHITECTS

Correct addresses of the following men:

Lawrence H. Bakken, Arch. '22, is living at 4819 29th avenue south, Minneapolis. He is working for the Northwestern Lumbermen's Association with offices at 1016 McKnight building.

Floyd Brown, Arch. '17, is living at 43 Dell Place, Minneapolis.

Donald Buckout, Arch. '17, can be reached at 1234 Ohio building, Toledo, Ohio.

Edgar Buenger, Arch. '19, is living at 1743 Eddy road, Cleveland, Ohio. He is superintending work for Architect Ellerbe of St. Paul.

George B. Deane, Arch., is living at 2712 West 43rd street, Minneapolis. George is employed by the Croft and Boerner Co., architects, of Minneapolis.

George Frazer, Arch. '18, is instructing at Cornell University, Ithaca, N. Y. Send his mail in care of the architectural department.

Henry Gerlach, Arch. '22, is living at 414 North Fourth street, Mankato, Minn.

Howard Haines, Arch. '21, is teaching architecture in a school at Oakland, Iowa.

Ralph Hammett, Arch. '19, can be located at 401 Education hall, University of Washington, Seattle, Wash.

Harvey King, Arch. '17, is head of the department of architecture of the North Dakota Agricultural college at Fargo. Ed. Halren, Arch. '23, is in the same department working under Mr. King.

Florian Kleinschmidt, Arch. '20, is an instructor in the architectural department of the Kansas A. & E. located at Manhattan, Kan.

Herbert Kreinkamp, Arch. '21, is living at 1100 West Eighth street, Los Angeles, Calif.

Linton Kreinkamp, Arch. '17, is living at 1344 Florida street, Los Angeles, Calif.

Edwin Loye, Arch. '21, is living at 226 Henry street, Brooklyn, N. Y.

George Prudden, Arch. '16, can be located at 221 Glynn Court, Detroit, Mich.

G. Stewart, Arch. '21, has offices at 207 Pittsburg building, St. Paul, Minn.

Harry J. Korsland, Arch '20, has been employed in the office of Francis J. Fitzgerald, architect, Alworth Building, Duluth, Minnesota. He recently matriculated at Harvard university, where he is studying architecture. His Cambridge, Mass., address is 102 Trowbride St.

George Dahl, Arch '17, is studying in Europe. Just where he is we do not know. He has a Harvard scholarship which he is working under.

Carl Gewalt is employed in architectural work in New York City.

Ray Lockwood, '20, is business affairs secretary of the St. Paul Association of Business and Public Affairs. Mr. and Mrs. Lockwood (Betty Forssell) wish to announce the arrival of William, their young son and heir.

M. D. McLean, E. '01, is living at 2330 Halstead Street North, Chicago, Ill. He is attending the McCormick Seminary, studying to become a minister. John Lilly, E. E., is attending the same school. There are four engineers at the McCormick Seminary. One of them is a graduate of the civil engineering department of Cornell University and has had three years of successful employment with the American Bridge Company of Pittsburgh.

ELECTRICALS

M. F. Wichman, E. E. '21, is with the engineering department of the American Telephone and Telegraph Company. He holds the position of inductive interference engineer. In preparation for this position, Mr. Wichman spent two months last fall in New York City attending the inductive interference school of the American Telephone and Telegraph Company. Seventy-two men from all parts of the United States attended this school. Mr. Wichman was representative of Minnesota. His work deals with the inductive interference of power and telephone lines. This is one of the big problems of the American Telephone and Telegraph Company and they are devoting a lot of time to its solution. Mr. Wichman was the first managing editor of the Techno-Log and it is to him the credit goes for the name "Techno-Log." Mr. Wichman spent a great deal of energy getting the Techno-Log started; in fact he, with his wife as a stenographer, spent many evenings working on the magazine. It was his foresight and good judgment which established the policy used by the Techno-Log at the present time. While at school Mr. Wichman was an active member of the University band and wears a key, symbolic of his worthy service. He is a member of Eta Kappa Nu, honorary electrical fraternity.

Daniel C. Elwood, E. E. '23, is a partner in an electrical repair shop at Decatur, Ill. He reports that they are enjoying good business conditions. He was married recently to Mrs. Hoaglin. A ten-year-old boy went in with the deal.

L. H. Gadsby, E. E. '09, was a delegate to the American Legion National convention at San Francisco, October 15 to 19, and writes that he saw lots of maroon and gold ribbons on Gopher State visitors.

He says: "It reminded me of the trainloads of rooters when Minnesota played football at Chicago and all of us who could scare up $6.00 for railroad fare went along and flaunted our colors all over Chicago. We had cause for celebrating, too, for this was in the days of the famous Eckersall. But Eckie that day couldn't find any holes in Minnesota's stonewall line, and our quarterback—Art Larkin, unless I am mistaken—got his punts off superbly and matched the best Chicago's most famous player could do. With Bobby Marshall's place kick for four points, Chicago was beaten 4-2, and none of us could talk in other than a hoarse whisper the next day."

Born to Mr. and Mrs. Clayton T. Gibbs a son, Marshall Dana, August 8. **Mr. Gibbs**, E. E. '18, is electrical engineer with Holmes and Sanborn, consulting engineers in Los Angeles, and lives at 215 East Bay State street, Alhambra, Calif.

C. W. Pearson, E. E. '22, having completed the Students' Training course at the Schenectady works of the General Electric Company, has been transferred to the Philadelphia office of that company.

The exhibit of modern lighting being held in the new Yeates Building, Ninth and Nicollet, Minneapolis, which has been held for the past weeks and which will close November 3, is in charge of **Ray Palmer**, E. E. '21. This exhibit is sent out from the head office of the National Electrical Lamp association of Cleveland, but is put on under auspices of

Minneapolis companies interested in better lighting. Mr. Palmer is one of about half a dozen Minnesota graduates putting on these exhibits for the head office.

Three lectures are given every day, and Mr. Palmer lectures on the commercial advantages of better lighting.

Charles S. Demarest, E. E. '11, broke into magazine writing some months ago with an article on "Telephone Equipment for Long Cable Circuits" in the November Journal of the American Institute of Electrical Engineers. Since graduation Mr. Demarest has been with the American Telephone and Telegraph Company in New York City.

George J. Schottler, E. E. '23, is assistant examiner in the United States Patent Office, his house address being 1330 Columbia Road, Washington, D. C. On the side, he is taking a night law course at George Washington University.

Arnim G. Olson, E. E. '22, has asked to have his address changed from 602 W. Jefferson St., Joliet, Ill., to his present habitation at 213 So. Euclid Ave., Oak Park, Ill.

H. R. Harris, E. E. '15, is selling electrical machinery. He has an office at 1123 Metropolitan Life Bldg., through which he represents several firms. "Sig" was a football man at Minnesota and coach of the freshmen teams for a number of years.

Doug Elliot, E. E. '15, is a consulting engineer with the Charles Pillsbury Company, of Minneapolis.

G. R. Jones, E. E. '15, is an electrical contractor with the Independent Electric Company, of Minneapolis.

MECHANICALS

Maurice Greenberg, Mech. '18, is living at 515 Capitol Boulevard, St. Paul, Minnesota. After graduation Mr. Greenberg remained at school as an instructor but later gave up his position when he joined the Navy, in which service he became an ensign. Shortly after he was released from the Navy he became cadet engineer with the Bailey Meter Company of Cleveland, Ohio, and has progressed to the position of manager of the St. Paul office, which is the headquarters of the northwest territory. The Bailey Meter Company handles all kinds of meters for power plants. Mr. Greenberg is a member of Tau Beta Pi and the Society of Mechanical Engineers.

Irving N. Eustice, M. E. '18, is employed by the Fairmont Gas Engine Works at Fairmont, Minnesota, as a gas engine designer. Walter F. Casper, M. E. '11, has been with this company for some time, and is now acting in the capacity of Mechanical Engineer and director of sales. Their main product is a motor propelled railway car known as the Fairmont Speeder.

Prof. J. V. Martenis recently received a letter from Mr. Victor Gauvreau, former assistant professor in gas engines, in which he states that he is now in Detroit, and is associated with Mr. Joseph Nelson, former instructor in machine shop practice in the Govro-Nelson Co., which is located at 3676 Trumbull Ave. They are engaged in automotive engineering and experimental work.

R. E. Meile, M. E. '21, is now working for the R. B. Whitacre Company of St. Paul as a salesman. Our natural deduction would be that salesmanship must be a healthy occupation as Mr. Meile says that he has gained over forty pounds since graduation.

Philip Swanson, M. E. '22, is now living at 1115 4th St. S. E. He was formerly in the employment of a copper company at Great Falls, Montana, as a draughtsman.

Verne Curtis, M. E. '21, has been employed by the Engineering Department of the City of Minneapolis since graduation, but has recently accepted a position with the Diamond Iron Works of Minneapolis as a designer of sawmill machinery. Verne is in quite a predicament as the board of directors at their last meeting refused to ratify his resignation.

Donald Captstick, M. E. '21, is now employed by the Detroit Blower Company of Detroit, Michigan.

Arthur W. Kumm, M. E. '22, is another engineer who has gone into the teaching profession. At present he is an instructor at the Rice Institute, which is located at Houston, Texas.

Rudolph Kuhlmann, M. E. '23, who was formerly employed by the Fairbanks-Morse Company of St. Paul, is now working with Delos F. Wilcox, consulting engineer and valuation expert. Wilcox recently finished a valuation of the Twin City Rapid Transit Company's lines, and is now making a valuation report on the Minneapolis Gas Light Company's plant.

"The best news I know is that on March 16, 1923, Louise Annette arrived at our home and has been making things interesting ever since." The happy father in this case is **George H. Bierman,** M. E. '19, of Cleveland, Ohio.

Shelden Hibbard, M. E. '23, has a position with the Clyde Iron Works of Duluth as estimator. His address is 1722 Jefferson street, Duluth.

Raymond C. Ascher, M. E. '23, is employed by the Lackawanna Steel Company, of Lackawanna, N. Y. He plans to go into the rolling mill department. He writes that his work is hard, but interesting.

Arthur Kumm, M. E. '22, is an instructor at Rice Institute, Houston, Texas.

Arthur Gilstad, M. E. '23, is with the Standard Conveyor Company, St. Paul. Art is making practical application of Professor Flather's industrial management course by taking time studies at the plant.

Geo. Putnam, M. E. '16, is employed as engineer for the State Board of Health of Missouri. He is located at Jefferson City, Missouri.

CHEMISTS

Francis C. Frary, Chem. '05, is living at 1218 Hulton Road, Oakmont, Pa. Since Dec. 15, 1918, he has been employed by the Aluminum Company of America as director of research.

W. L. Badger, Chem. '08, is living at 917 Church street, Ann Arbor, Michigan. He is professor of Chemical Engineering at the University of Michigan, where he has been since 1912. Professor Badger also holds the position of consulting engineer and director of research for the Swenson Evaporator Co., of Harvey, Ill. He has been connected with this firm since 1917. Professor Badger is a member of Alpha Chi Sigma. While at Minnesota he was a member of the freshman and sophomore debating teams.

SPORTS

CLIFFORD ANDERSON APPOINTED ASSISTANT MANAGER

Clifford Anderson, Sophomore Civil, was selected, by a manager board consisting of seven men from the athletic department, Earl Martineau, Ted Cox, Alfred Greene and Ted Waldor to become assistant football manager for next year.

This is one of the stellar positions of the year, resulting in his becoming football manager in the succeeding year and thereby winning a major "M." A candidate is picked on merits of scholarship, executive ability, personality, industry, reliability, initiative, and character. Out of nine candidates at the start of the season, "Cliff" Anderson was found to be the outstanding man in the above requirements. This placed the third engineer in line for the position since the institution of the manager system at the university. Al Greene and Ted Waldor are both engineers.

HOCKEY

The Minnesota hockey team, led by Capt. Frank Pond, senior mechanical, has started in whirlwind fashion by winning all games played thus far. On its first trip the team won handily from Eveleth Junior College by a score of 7-0 and defeated Hibbing Junior College 4-2. The goal guarding of Edwin Bergquist, senior civil, during the Hibbing Junior College game was especially brilliant.

"Parky" Flaaten, sophomore civil, playing left wing during most of the Eveleth game, showed thorough ability. This is Flaaten's first year of hockey at Minnesota. Nic Mann, mines, has starred in every game played by the team. He is holding down right defense. Pond at left wing is the outstanding star on the team. At Marquette, Pond shot the winning goal in each of the two hard-fought contests, both games ending 1-0.

In intramural hockey the college is being represented by a hockey team, and a schedule with other colleges will be completed on the parade grounds hockey rinks. Due to improved facilities great interest in hockey and other winter sports has been stimulated and Minnesota is certain to strengthen its position among the leading winter sport advocating colleges. The change from the crowded condition of other years is especially noticeable.

BASKETBALL

The basketball season for the Engineers is in full swing and the usual interest in the sport is being shown by the various classes. At a meeting of the Engineering College class presidents, the student class managers and the college athletic manager, the following inter-class schedule was arranged:

January 11—
Freshmen vs. Juniors.
Sophomores vs. Seniors.

January 22—
Freshmen vs. Seniors.
Sophomores vs. Juniors.

January 25—
Freshmen vs. Sophomores.
Juniors vs. Seniors.

Each class was represented by two teams—a first team and a second team. The first teams of each class played a round robin schedule and the second teams did likewise. A victory for a first team was credited five points, and a victory for the second team was credited with three points. By this system more men are given an opportunity to play and a true athletic interest is developed.

After this interclass schedule is complete an all Engineering college team will be picked and games with other colleges will be secured. Indications point that the Agricultural College and Mines will be among the foremost contenders for the All-University title.

The Sophomores and the Juniors are tied for first honors so far, each class being credited with eight points after winning two victories over their opponents, the Seniors and the Freshmen respectively. In the Senior-Sophomore game, Tews, a flashy forward, scored all of the field goals for the Senior first string men. Gerlach was high score man for the Sophs and put his team in the lead with three goals during the second half, after the first half had ended 7 and 2 with the Seniors in the lead. The game was marked by a display of good sportmanship on the part of both teams. The work of the guards was practically air-tight and the score was held down by their work. The game ended 11 to 9, Seniors.

The first team lineup is as follows:

Seniors		Sophomores
Kiesner	R. G.	Fitzgerald
Mayer	L. G.	Gerlach
Diment	C.	Johnson
Tews	R. F.	Baaken
Cass	L. F.	Foster

Substitution: Sanburg for Baaken.

The second string men of the Sophomore and Senior classes also played a closely fought battle. Tauritzen counted the Seniors two field goals, and Fletcher, Peterson and Fitzgerald scored for the Sophs. The lineup:

Seniors		Sophomores
Morton	R. G.	Johnson
Tauritzen	L. G.	Baaken
Kapple	C.	Kendrick
Schilling	R. F.	Fletcher
Moore	L. F.	Peterson

Substitutions: Baaken for Foster.

The Junior first team won easily from the Frosh by a 19 to 2 score. The strong Junior quint, with

(Continued on page 23)

EDITORIALS

"OLY OLEE YOHNSON
Ve Lick Visconsin, Yhou Bet."

The Minnesota Union Board of Governors has recently announced a Minnesota football song contest which is open to students, alumni and the general public. "There will be no restrictions as to working in teams, just so the song is original and dedicated to the University of Minnesota." (Minnesota Daily.)

Here is another chance for the engineer to step forward. We can write music if hard pressed and certainly there is no group more adequately fitted to write an expressive and original song. Years ago when Wisconsin first yelled:

An-oak-ka! An-oak-ka!
Ve beat Meen-a-sot-ta!

it was an engineer who answered the above. (We will claim him at least.)

In our new song can we not capitalize the popular opinion that we are of Scandinavian descent? Imagine a stirring march like "On Wisconsin" or "The Victors" with Minnesota spirit and loyalty written into every phrase and all of it in Swedish dialect. We have seen old Michigan men singing lustily and yet with the tears streaming down their faces. We have seen men weep when the old football song of their Alma Mater was being played. The music had feeling and power; the words had meaning; and the two together made men give their all. Minnesota has the men in field fighting for her and they give their best but with a fighting song with a smile and grin and the spirit and feeling of all behind it; these same men would give their all.

WE ARE REBUKED

We read with proper humility President Burton's indictment of college life as a thing of "rushing rabbles, jazz orchestras, pep meetings, frolics, hops and schedules fitted to make the second show at the movies." The effect of such an environment, he points out, is to militate against the spirit of higher learning, and Dr. Burton has done well to call us to repentance.

But as far as this Engineering college is concerned, we plead not guilty. The average student here hits a pretty steady gait in which wine, women and song are notable for their absence. A few lead a life which for austerity can hardly be matched outside a monastery.

Not that it is entirely a matter of choice. Most of us would be delighted to sin more often in the matter of an occasional "night out" if time and money permitted. But we are under severe limitations as to both. Almost any college president would tell us that these limitations were for our own good, and almost any student would agree that he was right "in principle," meaning it was a good thing for the other fellow.

With a considerable number of the students, the danger is not too much social life, it is too little. The time we spend in college is not merely a preparation for life, it is life, and unless we enjoy life here, there is no reason for thinking we will ever enjoy it.

A. R. M.

EXPLORATIONS IN LITERATURE

One of the criticisms of the engineer that we hear so regularly is that he is so engrossed in his profession that he lacks the culture of a general education. We do not care to argue as to the merits of this criticism, but would rather call your attention to something which is combating it and doing that successfully.

For the first time in the history of the Engineering College a course in directed reading has been offered. An enrollment of twice the number of students planned for is an indication of the enthusiasm with which this innovation was greeted—and to date this enthusiasm has not waned. As planned, a short survey of the principal literatures of the world is being made, and the best contributions of each are noted. The major part of the course is naturally outside reading, and for this we are allowed to make our own selections from the field we are then considering. Up to the present time we have been discussing French literature, and so great has been the interest aroused that it has spread to students not enrolled in the course who vie with each other and with us in obtaining their favorite French authors. During class hour, each student gives an informal talk on the material read, and by this method we not only get the benefit of our own readings, but we are able to judge the value of other selections. New fields, new worlds are opened to us. In the time allotted in school we may have time only to touch on some of these discoveries, but we know that when time is more plentiful we will explore, conquer and inhabit these new worlds. It means that henceforth we can so select our reading that a maximum of enjoyment will be combined with a maximum of cultural value. Culture is acquired only through experience, whether it be actually our own or that of some one else whose experience we have made our own. Can the engineer who has beheld the magic of Aladdin in the Arabian Nights, who has explored the depths and the highest heavens with Dante, who has laughed at the misfortunes of Don Quixote, who has pitied the plight of Anna Karenina, and who has stormed ancient castles with Scott, be accused of a lack of culture?

For the betterment of the engineering profession, it is our earnest wish that all engineering students consider this course when selecting their electives, and that the English Department arrange to take care of all those wishing to enroll.

J. E. M.

COLLEGE NEWS

MECHANICALS

A. S. M. E.'S HOLD ANNUAL BANQUET

The annual banquet which was held in the Minn. ball room on January 30 was, like many other things the A. S. M. E. does, a brilliant success. The stunts, readings, music and songs presented a variety of frivolity and entertainment. Stew. Willson acted as toastmaster and incidentally added considerable kick to the occasion. The Sophomore members were initiated into the mysteries of the A. S. M. E. and thus contributed greatly to the success of the evening. The old slogan: "All for fun, fun for all," applied quite well to this social event. The attendance was large but this was expected as the expenses were paid out of the A. S. M. E. treasury; in other words, it was free.

GEO. BERRY GETS PA. DEGREE

On January 8 another member was taken into the firm formerly known as Berry & Wife but now known as Berry & Family. On the morning of January 8 George appeared at school with a smile from one ear to the other and at first we thought congress must have passed the Bonus Bill but upon investigation we learned that he was the father of a baby girl. The thought has occurred to us that Berry might be setting an example to the newly-weds. Be that as it may, here are three cheers for Berry and another one for his family.

SEMINAR COURSE UNDERGOES REPAIR

The Seminar course which has been growing from bad to worse for some time has finally been revised and it is hoped that in its present form it will be helpful in giving the student a broader outlook upon his profession as well as give him some practical training in public speaking.

Under the present plan, a committee of three men select the topics for the men to talk on in class. A chairman is appointed to take charge of the meeting and introduce the speakers. Each speaker is allowed four minutes to give his talk and after he has delivered his speech, the chairman calls upon any one of the men who do not have topics to criticize the speaker and his speech. The idea of this criticism is not to ridicule the speaker or belittle his talk but rather to point out his faults and errors so that he may correct them. This change in the plan of Seminar is more or less of an experiment but so far it has worked out quite satisfactorily.

THE CLIMAX OF A SUCCESSFUL YEAR

Three more of our good looking instructors have succumbed to the barrage of a woman's love. During the recent vacation period Messrs. Campbell, Egry and Hazen embarked upon the sea of matrimony for parts unknown. Of course we're sorry it happened but now that all has been said and done, let us hasten to wish these newly-weds many happy and prosperous years of companionship.

SENIORS REORGANIZE EMPLOYMENT BUREAU

The employment bureau which was organized last year has been reorganized and will function in its former capacity with "Stan" Tuttle as manager and George Rathburn as assistant manager. The purpose of this organization is to bring the names of prospective employers and the nature of the work which they offer before the Senior Mechanicals. A mailing list and a form letter, which will probably be mailed out the first of next quarter, are now being prepared. It is hoped that this organization will be helpful in getting the right man in touch with the right job.

AERONAUTICAL ENGINEERING CLUB

The Aeronautical Engineering Club, which has been quite active in past years, will soon start holding its usual meetings again. At these meetings problems and papers of general interest are presented and discussed. All engineering students are eligible for membership and anyone who is interested is most cordially invited to attend these meetings.

S. B. T

ARCHITECTS

JANUARY DESIGN AWARDS

PARIS PRIZE—FIRST PRELIMINARY
ESQUISSE-ESQUISSE

An Entrance to a Thoroughfare

Mentions:
- Glanville Smith
- E. W. Molander

Note—These awards were given in the local judgment. The problem was taken by all Juniors and Seniors.

SENIOR SHORT

The Decoration of a Cabaret

Mentions:
- H. A. Magoon
- I. Woodner Silverman
- William Woollett
- Glanville Smith

JUNIOR ARCHAEOLOGY PROJECT

A Tower and Postern Gate

Mentions:
- Dorothy Brink
- Herman Frenzel
- E. W. Krafft

INTERIOR DECORATION
ESQUISSE-ESQUISSE

Treatment of a Ballroom Window

Conditional Credits:
- Helen MacGregor
- Gladys Hernlund

Alpha Rho Chi, national architectural fraternity, held its ninth annual convention at the Curtis Hotel, January 2 and 3, under the auspices of Mnesicles chapter.

The convention was attended by delegates from the chapters at Illinois, Michigan, Ohio, Virginia, California and Kansas, and also the officers of the Grand Council.

On the evening of the first day of the convention the delegates were entertained at a formal dinner-dance.

The final business session was followed by the traditional stag banquet at which Dr. W. F. Holman and Professor F. M. Mann were principal speakers.

Ann Arbor, Michigan, was selected as the meeting place for the 1925 convention of the fraternity.

High grades for the Architectural Department, Fall Quarter, as posted by the Dean's Office, were received by C. H. Hinman, a Senior, and Sidney Stolte, a Freshman. Eligibility to this list is governed by the student's having received no grade less than B in the final quarter grades.

MINERS

THE MINERS' ANNUAL SHINDIG

The fifth annual Miners' Shindig was held in the ballroom of the Minnesota Union on January 25. Among the several features of the dance was the Mining Camp Bar from which a cooling punch was served to the patrons by a terrible looking specimen of a westerner. This gentleman informed us that he had perhaps lost one eye but "you should see the other fellow." The check was operated by an equally rough character wearing a businesslike six shooter strapped at his side. The dress was quite fitting and proper for he relieved each man of his coat and hat. The ballroom was decorated for the occasion with several lights used by miners at various periods in history from the early coal lamp to the present carbide and electric. Here and there about the room were other interesting things, namely: crossed shovels, dynamite, dynamite cans, and a dynamite heater. One of the most unique features of the shindig was perhaps the program of dances or as it was called, the Method of Procedure:

1. Preliminary Traverse.
2. Transitmans Trot.
3. Tapemans Tangle.
4. Geologists Glide.
5. Trachyte Trip.
6. Felsitic Fox Trot.
7. Samplers Slide.
8. Miners Slip.
9. Muckers Ride.
10. Chemists Cuddle
11. Golddiggers Gallop.
12. Metallurgists Mingle.
13. Smelters Snooze.
14. Final Dividends.

Shares were sold in the Shindig under the name of Shindig Mines, incorporated under the laws of Bimini Bay. The chaperons were Mr. and Mrs. E. H. Comstock and Mr. and Mrs. J. C. Sanderson.

K. K. K. K. ELECTS

At a special meeting of the senior class of the School of Mines Tuesday afternoon, January 15, Elmer A. Jones was unanimously chosen to fill the exalted and honored position of the Grand Mogul of the Kash and Karry Kandy Klub of the School of Mines.

This organization is not widely known on the campus nor is it included in the list of campus organizations, but, nevertheless, it is a very powerful invisible empire among the Senior Miners. The elections each year are hotly contested but this year only one recall, due to protest, was necessary. Mr. Jones pleased everyone by winning the office in the final election from a field of four brilliant competitors. The general feeling of the class is that the best man won.

After the oath was administered, Mr. Jones assumed his duties of office and any afternoon in the week he may be seen making hurried trips between the School of Mines and the Minnesota Union. Anyone wishing any sweetmeats has but to say "Bonita," at which Mr. Jones, if present, answers "Wotinell."

CIVILS

J. A. L. Waddell, author, globe-trotter and bridge builder extraordinary, spoke at the Auditorium on January 10 before an audience of Civil Engineering students and faculty. "Opportunities for American Engineers in Foreign Lands" was the subject of his address, a subject he is eminently fitted to discuss, since he has spent a considerable part of his life in China, India, Japan and other remote places. Dr. Waddell especially recommended China and Latin America as places where engineers were needed and Americans would be welcome.

WE ALL DRINK IT

"My gosh, is that what we've been drinking?" gasped one engineer as he watched the machinery at the city filtration plant dumping chlorine by the gallon and alum by the ton into the city's drinking water. The sight was enough to alarm even a veteran of the surveying camp who drank without a shudder the vitriolic beverages of Cass Lake.

The foreman who was showing us the plant admitted with no trace of shame that they were putting an average of six tons of $AlSO_4$ into the city water—enough to kill 40,000 people or so, while the chlorine would account for as many more.

Putting poisonous chemicals in your drinking water sounds alarming, but as Rube Goldberg says, "it doesn't mean anything." Alum and chlorine don't hurt you because you don't drink them. The alum "coagulates" and settles to the bottom, carrying the algae with it, while the chlorine gets in its deadly work on the bacteria and then quietly passes off in vapor, leaving the water pure and harmless.

It doesn't hurt you, but it's tough on the bacteria. They come to the plant vigorous and prolific, every c.c. swarming with its teeming millions bent upon a career of predacious destruction. Then things begin to happen to them. Coagulation and filtration take a heavy toll, and the remainder are given a chance to demonstrate their fitness to survive in a solution of chlorine. The holocaust is terrific. Not even a Freshman math class is subjected to so severe a process of elimination. The one in 10,000 that survives is given a passing grade and sent on to the city to do his stuff.

This, in substance, is what the class in Water Supply learned on its trip to the city filtration plant at Columbia Heights. Incidentally, it all boils down to this: Minneapolis' annual typhoid rate up to 1911 was 34 per 100,000. Last year it was 2 per 100,000. Vive l'chlorine; abas l'B. typhoid.

CHEMISTS

COMING EVENTS

The School of Chemistry has been a quiet place during January. Few events have taken place which are worthy of public note. But again the restful spell is to be broken by a storm of action.

Wednesday, February sixth, will find Minnesota entertaining Dr. Ruth O'Brien of Ames. Miss O'Brien will deliver a lecture on the "Chemistry of Textiles" on the evening of that date in the Chemistry Auditorium. Her name and fame have spread afar, and no doubt she will have a large and enthusiastic audience.

While no definite date has been set, the Student Chemical Society is planning another get-together, which it is promised will be even more successful than the last. Bridge-hounds, 500-sharks, piano-pounders and others of similar mental bents will turn out for an evening of fun.

Although still a month or more in the future, all chemists are already looking forward to the annual Chemists' Banquet. The event has always been the bright spot of the school year, and we have every reason to believe that past records will fall to nothing compared with this year's edition.

Engineers' Day—what pleasant thoughts those words bring—to all but those who have come in contact with chemists on that day. We'll be in the parade again, but the success of our last float was so great that we do not expect to cause such physical and mental ruin this year as last. However, you can expect something just as original and effective as has always characterized chemistry floats in the past.

The Senior Chemical Engineers are already thinking, preparing and saving for the annual trip of inspection. During the Easter vacation they will visit Chicago, Milwaukee and vicinity and spend about ten days in inspecting industrial plants and other attractions which may come their way.

And of course once a month the Physical Chemists forget the Goddess of Sleep and write a monthly quiz. More power to 'em—they need it.

Yes, the month of January was quiet; but the months to come will more than make up for its deficiencies.

A WORTHY ORGANIZATION?

The Civils, as we have recently read, boast of an organization known as the Rubber Chain. They have taken it upon themselves to preach its merits to the technical campus at large. Therefore, We, the Chemical Engineers, feel justified in telling our brother engineers of our great organization, dear to the heart of every true Chemist—Nu Phi Gamma.

The University has given our organization no official recognition. If we should ask for it, we undoubtedly would be told to go—well, back to our studies. Nevertheless, we are proud of Nu Phi Gam and shall ever uphold her traditions.

Our organization is, of course, secret, and therefore we cannot tell you of its doings, its ritual and its motto. Neither can we tell you of its origin or the significance of its name. But we can tell you how chemists of today and tomorrow can earn entrance into its secret bonds, and shall promptly proceed to do so.

Every profession has within its ranks those who are truly of the rank—they can and do commit acts which are a disgrace to the man, his intelligence and his profession. These distinctive individuals have long been known and pointed out to the proletariat, but never before have chemists of such habits been honored with a distinction comparative with the wearing of a Tau Bete or Phi Lambda key. But justice has at last triumphed. These gifted individuals can now earn their way into the lofty halls of fame furnished by Nu Phi Gam.

Perhaps some of you do not realize what particular deeds must be done in order to win election and admission to the secret precincts of our order. Perhaps the best way to alleviate your ignorance is to cite a few examples of the greatest deeds which have been done by the present and past active members.

The Past Worthy Lord High Exalted Potentate of the order—the first of the tribe—earned his way into fame and was inspired to found this organization after he had invented and used a new and marvelous method for the qualitative detection of ammonia. Mr. F, as we will call him, conceived the idea of adding six normal aqua ammonia to the unknown solution, warming and testing the evolved vapors by red litmus paper. Who but a true brother of Nu Phi Gam would know that the NH_4 ion was present, proved by the change in color from red to blue of the litmus paper?

Mr. Z, as we shall call him so as not to reveal his true identity to the other Seniors in the School of Chemistry, earned his way into the select circle by a daring feat. He boiled an open beaker of alcohol over a free flame, never fearing the fire which surely resulted, and which necessitated the use of Mr. K's headgear to extinguish.

Brother Fuzzy defied the laws of gravitation, the yield point of glass and the cost of blue cards, and tested the elasticity of a Beckmann Thermometer by gently causing it to meet the floor in a method not unlike the movement of Newton's apple.

Many are the other deeds of valor found in the annals of the order. Great are its members. Keen is the competition for election to membership. But, aspiring youth in Chemistry, be not daunted! Wade into the stream and let your ingenuity carry you, too, over the billows of textbook knowledge and posted warnings to the restful isle of Nu Phi Gam!

ELECTRICALS

The sophomores in the signal corps unit of the R. O. T. C. in competitive drill the last part of the fall quarter provided one more argument in favor of the assertion that the engineers excel all others when they took high honors. Although the men had spent the greater part of the quarter on topographical work and had drilled only about two weeks in preparation for the event, they decisively defeated the infantrymen who had drilled the entire quarter.

When the appointments for cadet commissions were announced recently the signal corps unit was accorded the unusual honor of having a full fledged cadet captain appointed from its own ranks and assigned to command the unit. This man was Leonard O. Arstad '24. He is a member of the advanced course in the unit and was awarded a medal at Camp Custer, Mich., last summer for being one of the three best men in the entire signal corps company at the camp. The remainder of the men in the second year advanced course were appointed first lieutenants and all of the men in the first year advanced course were made second lieutenants.

This action is very commendable in that it is the first time in the history of the signal corps unit at Minnesota that we have been recognized by the military department as being a self-contained unit with our own organization and officers. Formerly either some cadet officer of infantry has been assigned to command the signal corps during formal inspections or parades or else some of the signal corps men have been made acting officers for the day. Also, whereas the position of the signal troops in line of march has been prescribed by the war department as being at the head of the column or near the commanding officer, yet in the R. O. T. C. formations the signal corps unit has invariably been found at the end of the column.

Mr. Douglas of the steam turbine department of the General Electric Company, on a trip through the city on January 9, stopped off long enough to deliver an unusually interesting and instructive talk before the student branch of the American Institute of Electrical Engineers on the recent improvements in steam turbines. He described the methods adopted to make use of the entire heat content of the steam put into the turbine by tapping off a certain amount at a number of different points along the path of flow of the steam through the turbine. He also described the design policy of the General Electric in making turbines in three sections such that the middle section could be omitted for jobs requiring less power than that of the entire unit. By varying the design of the disks as well as the number used in the motor a very large number of different powered units within wide limits are obtained with a standard turbine head and casing, thereby greatly reducing the cost of manufacture and yet allowing generous leeway in fitting the machine to the individual job on which it is to be used.

The meeting was very well attended by the electricals and was greatly augmented by the presence of a goodly number of mechanicals who turned out to learn of the progress being made in their field by a concern interested primarily in the development of the electrical industry.

The annual lecture to the sophomore class on storage batteries was delivered January 17 by P. G. Downton of the Exide Storage Battery Company. Mr. Downton exhibited the parts of a battery and explained the assembling process as well as the chemistry of a lead battery. He gave many interesting statistics on the variety of uses to which the storage battery is put and gave representative figures on the quantities so used. The lecture was illustrated by means of slides.

During the last few weeks the seniors have developed a very alarming propensity for the intimate study of the various methods of rendering the meters of the department useless for the usual measuring purposes. A couple of Tau Betas, aided and abetted by other prominent members of the class, insisted on leaving a milli-ammeter connected to the slip rings of an induction motor when they stopped it! The meter is on its way back to the factory now!

Not to be outdone by mere Tau Bets that same week another group twined the pointers of TWO voltmeters around the stops at the upper end of the scales. S'matter "Joe?" did your girl need some new hair pins? Luckily for the group "Chuck" Skarolid came to the rescue and stuck in as new pointers a couple of hunks of annunciator wire appropriated from a radio station when Braden's back was turned. Nor are the post-grads immune from this all-absorbing research problem as evidenced by the fate that befell the large electro-static voltmeter which, according to good authority, cost a hundred dollars and took three weeks to calibrate. Ask "Cliff" Sampson for details.

No longer can the communication department be accused of holding the record for making progress in this field. They have not burned out a single instrument this quarter!

SPORTS

(Continued from page 16)

exception of Kreger, is made up of men who played together on the Sophomore championship five of last year. The lineup:

Juniors		Freshmen
Freberg	R. G.	Lagman
Eggleston	L. G.	Nelson
Kreger	C.	Johnson
Burns (Capt.)	L. F.	Dispard
Hendrickson	R. F.	Gochike

Substitutions: Buttermiller for Johnson.

Kreger led the scoring with four field baskets. Capt. Dwight Burns made three.

Two of the Engineers' most evenly matched teams met when the Junior second team played the Freshmen. The score ran neck and neck throughout the game and when time was called the score stood 18 to 18. A free throw called a few seconds before the final whistle was thrown and made, and the game was won by the Juniors. Frequent substitutions were made, adding to the speed of the game. Personnel of teams:

Juniors		Freshmen
Larson	R. G.	Strand
Jacobson	L. G.	Backstrom
Peterson, Waldor	C.	Sweppe
Quinn, Johnson	L. F.	Richardson
Haima	R. F.	Fox

THE CORRUGATED METAL CULVERT

(Continued from page 8)

facturers themselves have developed a broader viewpoint and have taken decided steps to improve their product and its manufacture and to study the uses to which the metal culvert may be put. As a result of these things, engineers and users of corrugated culverts in general are coming more and more to recognize this type of structure as a permanent one and are giving it a place in their construction programs.

PROF. RYAN ELECTED PRESIDENT OF A. I. E. E.

Harris J. Ryan, internationally known electrical engineer and scientist, professor of electrical engineering at Stanford University, California, was elected president of the American Institute of Electrical Enigneers at the annual business meeting held in the Engineering Societies Building, New York, Friday, May 18th.—Federated American Engineering Societies Bulletin.

TECHNICALITIES

Ye Ed. has been criticized by the Big Boss for wearing out the scissors cutting out jokes for this page. He wants more local humor. Believing in safety first as I do, I don't want to print the best jokes around this institution as I might get booted for insulting the faculty.

So I will not offer the biggest jokes for your approval but will confine myself to the lesser lights.

How's this for a starter:

AL. GREENE'S FORD
THE TECHNICALITIES PAGE
GARZON'S MASTERPIECE STRAINER
McCRADY'S COMMISSION IN THE R. O. T. C.
RUBBER CHAINS
PLUMB BOBS
TAU BETES
EXPLORATIONS IN LITERATURE

Saw a dress at the Miners' Shindig without any shoulder straps—it probably cost plenty, but as far as I could see there was no upkeep.

SIGN IN THE CHEMISTRY BUILDING

ANNUAL CHEMISTS' GETDRUNKTOGETHER
NEXT WED.
ON ACCOUNT OF THE HIGH PRICE OF LIQUOR, BRING GINGER-ALE

(We'll get ethyl from the store room)

OVERHEARD AT THE MINERS' SHINDIG

She—I wish the music would start; I want to dance the worst way.

He—Sorry, old Dear, the chaperones are very strict.

I went to see my girl a few nights ago and we sat in the porch swing discussing such weighty subjects as the high tariff on moth balls and the fermentation of wild honey. Conversation lagged. Then she asked me if she were the only girl I had ever kissed. I was startled because I hadn't kissed her yet.

I wonder—oh, I wonder!—Ranger.

REAL SALESMANSHIP

Hesitant Flapper—Aren't these hose a bit flashy?

Keen Salesman—Yes, miss; indeed they are, and the papers forecast strong winds for the next few days.

Hesitant Flapper—I'll take them.—Boll Weevil.

Pledge—Say, Dick, if I take a date up to the city, and bring her back on the last car, and she invites me to sit down in the porch swing a while, shouldn't I refuse?

Phi Gam—My yes, by all means. Oh, by the way, what did you say her name was?—Whirlwind.

THE FRENZIED COPY-WRITER

It was the last quarter and the score was tied. Montmorency was at bat. He'd show them. "I'll make that eight ball in the side pocket or die in the attempt," he said as he ferociously adjusted his helmet. "Serve," he cried, and the gallery roared their approval. The puck was now in his possession. Magnificently he dribbled it to the very shadow of the goal post, when, horror of horrors, someone fumbled and the opposing team recovered. Using a right to the heart and a cross to the jaw, which seemed to bewilder Montmorency's Demons somewhat, the opposing team gained steadily. Not for long, however, for Monty, crafty athlete that he was, intercepted a faux pas, hopped a Yellow and rode three miles for a touchdown.—Juggler.

THE BIRD OF PARADISE

It was at a fashionable London dinner, where brilliant guests made merry amid the sumptuous luxury of their titled host. The table was lighted by myriads of tall candles which cast flickering shadows on the faces of the brilliant company.

Next to the Bishop sat a young girl, noted even among these blasé folk as one well versed in repartee. She provoked gales of laughter from her reverend partner thoughout the dinner. It so happened that during the fish course the Bishop chanced to spill some salt. Gracefully he took a pinch of it in his long tapering fingers, tossed it over his left shoulder with some petty badinage. Unfortunately, some of the salt chanced to slip down the maiden's back. Thereupon she, with a roguish smile, wagged her finger at His Grace and remarked:

"Ah, ha! Bishop, you can't catch me that way!"—Harvard Lampoon.

LOW-DOWN

Pat was on a great ocean liner bound for America. It was his first trip on the water and every ordinary event on the boat was a new one in Pat's repertoire of experience.

On the third day out the ship burst into flames. The fire was rapidly consuming the huge boat.

All the passengers were appropriating the life preservers, life savers, and life boats. Pat stood by for a few minutes, watching the mad rush. Finally, perplexed and disgusted, he exclaimed:

"Well, if everybody is going to steal stuff off o' the ship, I'll be gosh durned if I don't get in on the stealin' myself."

So saying, Pat grabbed a crowbar and jumped overboard.—Sun Dial.

She (suggestively)—That roast duck in the window makes my mouth water.

The Brute—Then spit.—Widow.

FACTS YOU MAY NOT CARE TO KNOW

In a recent drive for funds for the Ku Klux Klan, both the Ancient Order of Hibernians and the Jewish Relief Society fell far short of their quotas.

The foundations of modern hydrology were laid in 1431, when it was first noted that the number of people carrying umbrellas on rainy days was markedly greater than on those days when the weather was clear.

Spurs are worn by officers at the armory not only to keep their feet from slipping off their desks, but also in deference to War Department orders.

If all the convocation speeches made in the Armory were placed end to end they would fill one modern blimp, with enough over to obviate the importation of nitrates from Chili.

It has recently been shown that the natural luster of the human nose may be considerably dimmed by the application of either powdered talcum or lamp black.

In certain districts of western Ireland custom requires that every adult male shall undergo a depilatory operation once each week, resulting in a temporary abatement of hirsute florescence.

The campaign to provide mackinaws for the hairless dogs of Mexico is being carried on in spite of the insurrection.

A recent census disclosed the fact that a majority of the "Arabs" are not of Arabian descent at all, being for the most part Swedes and other Nordic elements. The name "Arabs" was applied to them because a large percentage were sheiks.

ARCHIE McCRADY.

AREN'T WE ALL?

Teacher: "Who signed the Magna Charta?"

Youngster: "Please, ma'am, 'twasn't me."

Teacher (disgusted): "Oh, take your seat."

Skeptical member of school board: "Here, call that boy back. I don't like his manner. I believe he did do it."—New York Sun.

WHAT'S IN A NAME

An English motorist was stopped by a policeman on account of poor lights.

"I'll have to take your name, sir."

"John Smith," was the reply.

"Don't try that on me, sir," warned the man in blue. "I want your proper name and address."

"Then if you must have it, it's William Shakespeare, Stratford-on-Avon."

"Thank you, sir," said the policeman, jotting it down. "Sorry to have troubled you."

"Don't mention it," said the motorist, driving on.—Des Moines Register.

THE EXECUTION OF THE NOBLE ARTS OF MODERN DANCING

In view of the approaching J. B. and other social functions of prominence, the Technical Commission has seen fit to publish the following instructions so that we hard-boiled Engineers can hold our own with the talented Arts College inmates.

Helpful Hints to the Uninitiated

Veiling your ignorance with a masterful look of grim determination, do not hesitate to saunter boldly over to the best little stepper in the hall and ask her for the first dance. She may possibly be surprised, but she will no doubt rise to the occasion with a smile.

As she wilts gracefully into your arms, seize her—gently, if possible, but firmly, at all costs—and, propelling her along in front of you, stroll leisurely across the hall. Your college training will here assert itself, and, as the result of long practice in wandering aimlessly around the corridors between classes, you will automatically drop into the well known "Walk Collegian." When you become fatigued with the exertion of pushing the girl around, merely reverse your direction and let her push you. In any case, a zigzag course is the most effective to pursue—it enables you to meet every one in the hall more or less informally.

Assume your best air of nonchalance and keep up a steady conversation about all the dances you have attended lately. It is most effective, also, to enter upon a lengthy but modest account of the numerous prizes you have received for your prowess as an exhibition dancer. Interrupt yourself at frequent intervals in order to whistle debonairly, keeping just enough ahead of the orchestra to show that you know the tune. This will make a big hit with the girl and will help to keep her mind off your dancing.

When you bump into a couple, look the offending man straight in the eye and sneer contemptuously. He will promptly apologize.

Make constant disparaging remarks about the orchestra. This will help your case when you discover after the fifth encore that you have been fox-trotting to a waltz. Just pass your mistake off with a superior laugh, and explain that "Hot Lips" was being played so badly that you mistook it for "Kiss Me Again."

Should you, by any chance, tread on your partner's toes once or twice, smile condescendingly at her and assure her that you did not mind in the least—she is improving every minute.

Make her feel your superiority, but don't be too harsh with the poor girl. As you escort her back to her seat at the end of the dance, put her at ease by promising her that if you can possibly manage it you will favor her with another dance before the evening is over. She will probably swoon with delight.—Beanpot.

An army surgeon was examining a cow-puncher recruit.

"Ever had any accidents?"

"No."

"What's that bandage on your hand?"

"Rattlesnake bite."

"Don't you call that an accident?"

"Naw; the dam' thing did it on purpose."—Record.

A ONE-ACT PLAY

Dramatis Personae—Mamma—Papa—Willie—Elephant.

Location—Circus.

OVERTURE

(Enter Mamma, dragging Willie, who carries: 1 Balloon, 7 Bags of Peanuts, a Mouthful of Popcorn, and 1 Pea-shooter.)

Willie: Mamma, do elephants swear and say "Damn" when they sit down?

Mamma: No—Don't be foolish!—I wish I could find your father!

Willie: Mamma, do elephants sort of "gurgle" when they sit on their hind legs?

Mamma: Stop that foolishness at once, Willie, and help me find your Papa!

Willie: Well, if elephants don't swear, I guess that was Papa's shoe sticking out under the elephant's tail.

CURTAIN

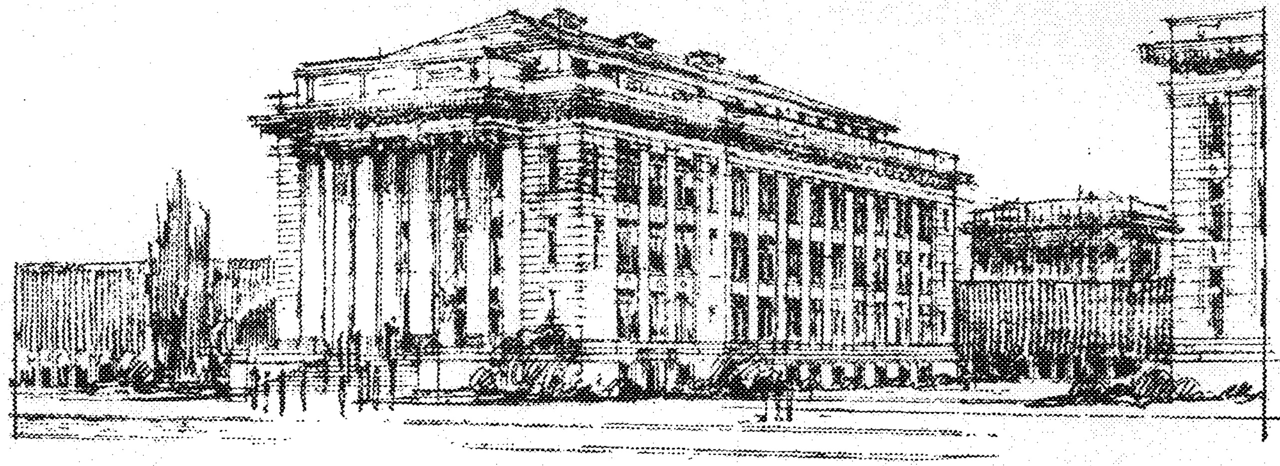
Coach—"Why didn't you turn out for track practice yesterday?"

Lusty Lunged Lew—"I had a date, sir."

"Had a date, did you?"

"Yes, sir, but I didn't break training. A miss is as good as a mile, you know."—Flamingo.

I got a man,
He's six feet two;
He don't love many,
But, Lordy! when he do:—



New Administration Building—(Alumni Weekly)

ADMINISTRATION BUILDING NEXT

(Continued from page 7)

third floor as an inspection of the plan will show.

In addition to the floors shown herewith, two floors are to be utilized in the roof house, the roof house and attic floors. Space forbids the publication of these plans, but it is sufficient to say that the entire roof house floor is devoted to the general offices of the ever-growing General Extension Division while the attic floor is given over to their moving picture studio with a glass roof, together with dark room and projection facilities. Here, also, will be located the film and plate inspection and repair rooms and some storage space. However, the main fireproof storage for films will be in the sub-basement, which will be connected with a dumb waiter not shown on the plans.

Officials of the University, students and graduates will all be interested in the completion of the administration building a year and a half hence, as it means the tearing down of the old Mechanic Arts building and the diverting of the Old Library building to other purposes, as all the various major business activities are brought together under one roof in a location equally accessible to all portions of the Greater Minnesota Plan.

Percy Flaaten, Sophomore engineer, dislocated his knee in the last hockey practice before the team went to Madison. He has been getting to and from his classes with considerable difficulty and the aid of crutches.

ALUMNI SHOW INTEREST IN COLLEGE

(Continued from page 11)

position, Mr. Curtis directed operation, maintenance, and construction work in the plant, handled reports and studies of department operation, and was in charge of the design of the new plant. His experience in municipal work has familiarized him with the duties of supervisor, so that he steps into his new position thoroughly versed in the problems which will confront him.

It is peculiarly fitting that Mr. Curtis should be a factor in directing the municipal business of Minneapolis, since he is a product of the educational system of this city. During his four years at West high school, he was active in athletics, winning his letter in the 100-yard and 220-yard events in track; he was an important man on the baseball and cross-country teams.

Mr. Curtis was a member of the mechanical class of 1922, affiliating himself with the American Society of Mechanical Engineers and the Association of Engineering Students. He is a member of Theta Tau, professional engineering fraternity.

One of the youngest men in the city engineering department, Mr. Curtis nevertheless is one of the most enthusiastic regarding the possibilities of his field. "In the municipal branch of the game," he states, "there are few engineers. It has usually been under the control of health officials, but it is getting to be more of an engineering problem. There is work for both civils and mechanicals; civils in routing and distribution of the collection service, and mechanicals in the incineration and reduction work."

"I would advocate," Mr. Curtis says in regard to the University courses, "taking more business subjects in co-ordination with engineering work, preferably as electives. I recommend that economics, cost accounting, and corporation finance be included, stressing the study of report writing. I note with pride the development of the engineering college, particularly the electrical department, which leads me to hope that the University will not be long in the construction of a new and complete mechanical building, it being sorely needed at this time. The University is fortunate in having a splendid group of capable and versatile men as a mechanical faculty. But they are hampered in a lack of suitable facilities, notably shops and proper recitation and drawing rooms."

HISTORY OF ST. PATRICK'S DAY

(Continued from page 9)

On Friday night the Technical Commission will be the host of the visiting delegates at a Theatre Party. Mr. Frederick Kapple is Chairman of General Arrangements for the evening.

On Saturday night, Feb. 16th, the Technical Association will give a dance at the Minnesota Union in honor of the delegates. The dance will eclipse anything that has ever been given at the Union. A seven-piece orchestra, novelty dancing, novelty numbers, new lighting effects, unusual decorations are being planned. The following dance committee are at work to make this the biggest campus dance of the year:

Roscoe Bauer, Chairman of Tickets and Arrangements

Reuben Grant, Chairman of Chaperone Committee

(Continued on page 30)

Clarence Velz, Chairman of Publicity Committee

Frank Roos, Chairman of Entertainment Committee

The students of the Colleges of Engineering, Architecture and Chemistry have the opportunity to serve themselves and the University in the coming convention. The reputation of our Colleges and our University will be determined by the manner in which we entertain our delegates. These men will leave the convention and go back to their respective schools carrying the spirit of Minnesota. The Engineers have never failed in anything they have undertaken, and in consequence it is our duty to impart to them the true Minnesota spirit. The students can do their part by turning out en masse for the smoker and the dance.

THE VEE-TYPE CADILLAC ENGINE

(Continued from page 10)

be proved that any other form of engine not conforming to the convention would prove practical, but since the Cadillac V-63 engine has proved satisfactory so far, future experimenters may feel encouraged to try other departures from this convention. The use of a crankshaft symmetrical about a transverse plane through the center of a motor is a vital element in one scheme of balancing which has worked very successfully, but other equally good methods may be found.

THE NORTHWESTERN CARRIES ON

(Continued from page 5)

above 70 for a sound financial condition. Note the extreme fluctuation and generally low average during the earlier years, the gradual rise from 1896 to 1916 and the rapid rise during the war. The Chicago Northwestern was much more fortunate in this respect than many other roads.

The curve showing "miles operated" shows the gradual extension of the system. In one or two years there has been a decrease in miles operated, but these reductions are too small to be shown in the curves.

The passenger traffic shows a gradual increase for nearly every year. Note the decrease in 1921.

The freight traffic shows more fluctuations. The curve shows a general increase in business, but the effect of the panics is clearly noticeable. Note the enormous decrease in 1921.

The "receipts per passenger-mile and per ton-mile" show decreases until about 1917, when large increases were allowed by the I. C. C. The receipts per ton mile in 1917 were 78 cents and this had increased to $1.41 in 1921. The receipts per passenger mile reached the low figure of $1.81 from 1908 to 1912, when increases are noticed. These receipts had increased to $2.85 in 1921.

In spite of the increased rates for passengers and freight, the increased operating expenses and decreased traffic caused a deficit in 1921 for the first time in the history of the company since figures are available. The official figures for 1922 and 1923 have not yet been published but from the best information obtainable, conditions will be much improved.

THE MINNESOTA MARINE MOTOR

AN INTERESTING little motor is being built in the Mechanical Engineering machine shops under the direction of Prof. Shipley. The engine is unique in appearance and design and tests have indicated that it is thoroughly practical and will fulfil the expectations of its designer.

The engine is a three-cylinder, two cycle, water-cooled marine engine. Each cylinder has a separate water jacket, mixing valve, and intake manifold. Since many of its parts are made of aluminum, the motor is very light, which is an unusual feature for a marine engine. The time and labor required to build this engine were greatly reduced by using parts of the one cylinder motor. As a word of explanation, it might be said that one cylinder rowboat motors similar to the common commercial ones are being made in quantity production by the machine shop students. The crank-case ends, pistons, connecting rods, intake manifolds, mixing valves, cylinders, and flywheels are of the same dimensions and material as the similar parts of the single cylinder motors.

The aluminum crank-case is composed of three pieces bolted together and has three separate compartments, as a two cycle motor must have an air-tight crankcase for each cylinder. The crankshaft was built up of three sections using sections of the single throw crankshafts and thus saving considerable work. The necessary sections were cut off the single throw shafts used for the one cylinder motor, their ends slotted and mated, fitted together at 120° and a sleeve shrunk over each of the joints. The sleeves fit in the middle bearings of the crankcase, making four bearings in all.

The piston is made of cast iron but the design has been altered somewhat from the original so as to give a greater volumetric clearance in the cylinder head. It was found by experiment that by reducing the size of the baffle projection, which is common on the pistons of most two cycle engines, the motor would run faster and develop more power and produce less vibration. Theoretically this lowering of the compression ratio would reduce the efficiency, but it appears that the mechanical efficiency was increased more than the thermal efficiency was reduced.

The connecting rods are of the tubular type and are made of alloy steel. This construction makes them lighter than the forged ones and possess an additional advantage in that the bearings and wrist pin may be easily replaced.

The use of aluminum water jackets is a unique feature as it eliminated the necessity of complicated coring on the cylinder. These jackets were pressed out of sheet aluminum and a steel ring was pressed and sealed into the bottom end of each jacket. These steel rings were accurately turned and so were the corresponding cylinder surfaces. The jackets were fastened and sealed onto the cylinders by heating the ring and then shrinking it on.

The timer is of a simple design and is located between the flywheel and the crankcase. Dry cells and a coil are used for ignition. The throttle valves are controlled by one rod which is connected to all three mixing valves. Another appreciable reduction in weight was accomplished by using small aluminum intake manifolds instead of casting the gas passages integral with the cylinder and crankcase castings as is the common practice.

The flywheel is a turned cast iron one, similar to the ones used on the single cylinder motors. The water pump will be of the gear type, similar to the oil pumps used on most auto engines. Another unique feature is the small starter which will be mounted on the engine.

The motor will be equipped with a two speed transmission which is not quite completed as yet. The transmission is composed of an epicyclic train of gears mounted in a small drum with two sets of friction discs and a larger encasing drum. When the transmission lever is in the normal position, the propellor will revolve directly with the engine. A pressure on the transmission control lever causes one set of friction discs to engage and allow the propellor to remain idle. Further pressure on the lever causes the second set of friction discs to engage and put the epicyclic gear train in motion and thus reverse the propeller. The gear train is designed so that the propeller will not revolve as fast as the motor when in reverse gear.

Internal lubrication of the motor is accomplished by mixing oil with the gasoline. The crankshaft bearings are lubricated by means of ordinary grease cups. This system of lubrication has proven entirely satisfactory on the one cylinder motor and so it has been adopted for the three cylinder motor.

The engine had not been thoroughly tested at the time this article was written but preliminary tests indicate that it will develop about 8 H. P. at 1,000 R. P. M. It has a bore of 2⅝" and a stroke of 2¼". Although we cannot make any great prophecies for this motor it has many distinctive features and its development and construction has been viewed with considerable interest. H. F. BESELER.

WORK FOR ENGINEERING SCHOOLS

Industry is going to need 400,000 more persons for positions of responsibility by 1930, besides the replacements in the 1,500,000 administrators and technical experts now employed. This is the conclusion of the National Industrial Conference Board from an extension of current statistics and a consideration of the growing complications of industry. These figures are easy to believe, but the collateral assumption that this means a proportionate burden on the engineering school is not so convincing. It is, no doubt, a fact that industrialists generally are beginning to have a much better appreciation of the advantages of a technical education in the administration of industry, but engineers should not delude themselves into believing that the future executives are all coming from the engineering profession. The report of the Board partakes of the common failing of industrial leaders of considering the problem of engineering education mainly the most efficient production of human material to fit into the major gears of the industrial machine. Insofar as the changing industrial process is to call for more and more engineers to do strictly engineering work the Board's conclusions are sound. Engineering schools must prepare for a growing increase in that demand. As to the necessity for an engineering training for the future administrator it depends on what one calls an engineering training. From the Board's report and the suggestions of similar nature that industry occasionally offers, the proposed training is industrial rather than engineering. It may be that the engineering school can furnish such training better than any other, but it should be clearly understood that the products of it are not so much engineers as

Library Eng.

ROGER BACON
1214-1294

English philosopher and man of science. Studied at Oxford and the University of Paris. Wrote the *Opus Majus*, *Opus Minus*, *Opus Tertium*, and many other treatises.

For this he was sent to prison

Roger Bacon may not have invented gunpowder, as has been claimed by some biographers of the famous Franciscan friar, but he exploded some of the outstanding errors of thirteenth century thought. Because of his advanced teachings, Bacon spent many years of his life in prison.

In an age of abstract speculation he boldly asserted the mathematical basis of all the sciences. But even mathematical calculation, he showed, must be verified by experiment, which discovers truths that speculation could never reach.

In the Research Laboratories of the General Electric Company, Bacon's principles are followed in every experimental investigation. The gas-filled electric lamp and the electron tube were worked out on paper, but it was experimental verification of the underlying mathematical theory that made electric illumination, radio broadcasting and X-rays what they are today.

More than a million dollars a year is devoted to research by the General Electric Company in order that the giant—electricity—may be made more and more useful to mankind.

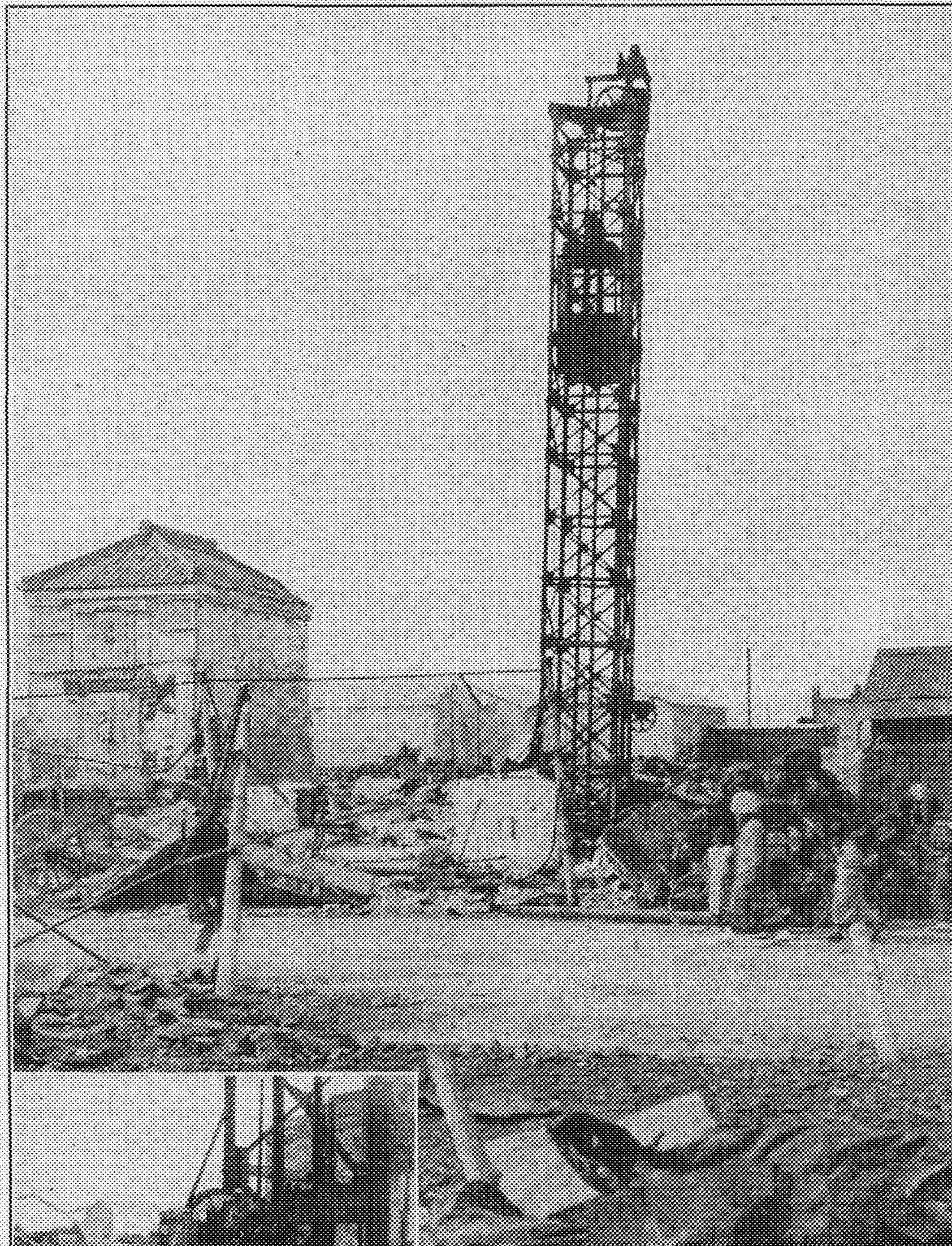
GENERAL ELECTRIC

MINNESOTA TECHNO-LOG

VOL. IV. NO. 5 MARCH 1924

Published Monthly During the School Year by the Students of the College of Engineering and Architecture, School of Chemistry and School of Mines of the University of Minnesota

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED


© PACIFIC & ATLANTIC PHOTOS, Inc.

INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

Published and Copyrighted Monthly by

The Engineering Students
of the
University of Minnesota

Main Engineering Building, Minneapolis, Minn.

Subscription $1.50 per year — Twenty-five Cents the Copy

VOLUME IV — MARCH, 1924 — NUMBER 5

TABLE OF CONTENTS

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: Prof. Edwin Kurtz, Iowa State College, Ames, Iowa

The Cornell Civil Engineer
The Transit
Iowa Engineer
Colorado Engineer
Nebraska Blue Print
Penn State Engineer
Sibley Journal of Engineering
Rose Technic
Michigan Technic
Minnesota Techno-Log
Virginia Journal of Engineering
Ohio State Engineer
The Towne Scientific Journal
Wisconsin Engineer
Illinois Technograph
Tech. Engineering News
Kansas State Engineer
Princeton E. A. News Letter
Kansas Engineer

Minnesota Techno-Log

University of Minnesota

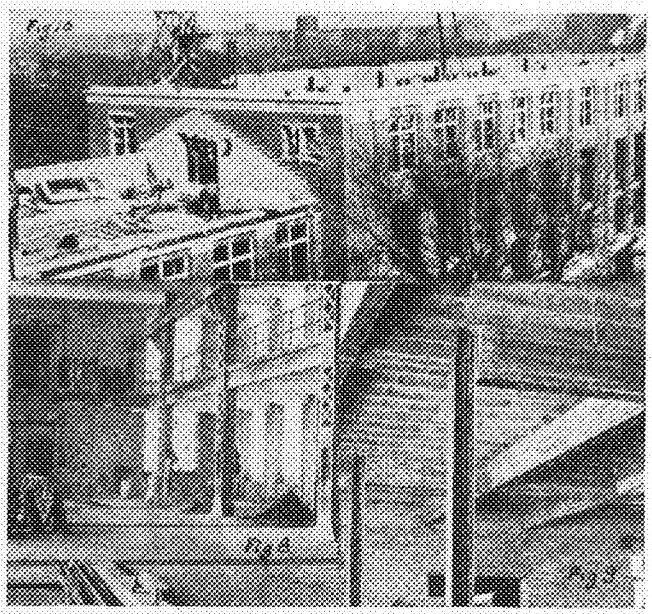
VOLUME IV MARCH, 1924 NUMBER 5

FUNCTIONAL PLANS OF NEW UNIT

Details Decided After Many Years of Study---Devices Will Save Time For Future Students

By Professor F. W. Springer

THE sketches accompanying this article will be used to illustrate the arrangement and relations of the various laboratories in the new Electrical Engineering Building. Several photographs indicate certain structural details that affect certain building functions in particular.



An article by Mr. C. W. Teal, E. E. '24, published in the January, 1924, issue of the Minnesota Techno-log gives a good general description of this building and is accompanied by a photograph showing the appearance of the south side of the laboratory wing and the two wireless towers.

Twenty-five years ago, when wooden fuse blocks were still in use, six or seven senior electrical engineers constituted a good-sized class. The present class has sixty-seven seniors, with other departments of the college taking work in the electrical building showing a corresponding growth. During this period almost a continuous study was made of electrical laboratories in order to obtain the best possible arrangement and functions in a new building.

The arrangements shown have been influenced by a number of factors:

(1) Valuable experience was acquired during a quarter century under rather unfavorable conditions with more or less temporary housing in three different buildings. As necessity is said to be the mother of invention, this experience resulted in a number of developments which were of help in making the new design.

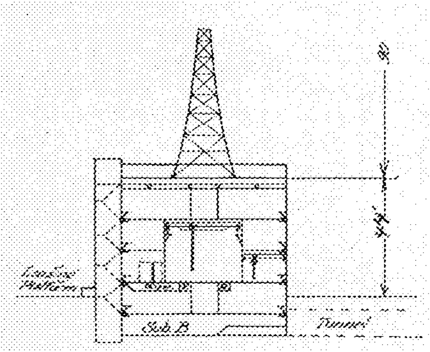


Fig. 4

(2) Many laboratory features were the direct result of keeping with the current of progress in the electrical art.

(3) The experience of others, including their mistakes and limitations, led to the adoption of just the opposite in the design of some features.

(4) The location and shape of the building was determined by the future needs of the University and of the College of Engineering and the persistence of the belief that the "T" shape would prove to be one of best possible. This matter was given most careful and patient consideration by the University authorities.

The limits set by the group of which this building is a part, involving shape, size, levels and other architectural features, are not thought to have had any great effect in either the essential arrangement or functions of the laboratories.

(5) A generous appropriation of $375,000, set aside for the building and equipment by the Board of Regents, will enable the building to be made complete in all essential features, and will also permit a substantial increase in portable equipment.

All of the above factors may be regarded as very favorable to the development of a satisfactory set of plans.

Details of Plans

The photograph of Fig. 1 is taken looking southeast as on a line running from the upper left to the lower right of the ground plan. This photograph shows the head house, 69' by 70', and containing offices, basement research laboratories, class rooms and lecture hall, the neck or connecting link, 51' by 40', containing laboratories and laboratory offices, and the laboratory wing 155' by 60'.

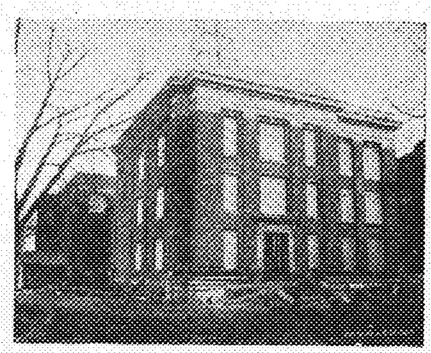


Fig. 2 is a section of the laboratory wing and shows the dynamo laboratory occupying the first and second floors with the main switchboards and instrument cases and the service elevator at the left or north side of the laboratory and approximately at the center of gravity of the laboratory system.

The above divisions being fixed, the remaining elements follow almost as a matter of course as shown in Figs. 3, 4, 5 and 6 of the basement, first, second and third floors, respectively.

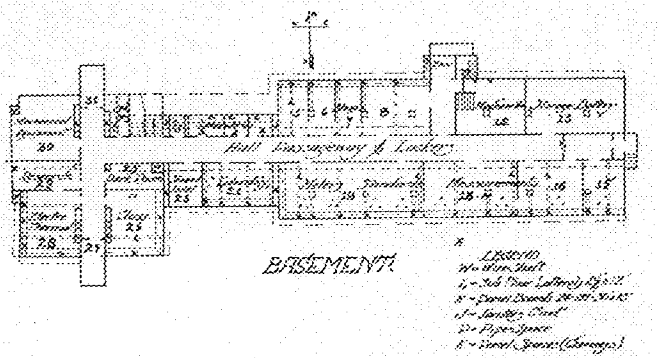


Fig. 3

Figs. 8, 9 and 10 show those details of construction which are particularly associated with function. Fig. 8 is a view of the northwest corner of the main laboratory on the first floor. It shows the surface wire trenches or "laterals" to be referred to later, running across the floor from right to left in the photograph, the construction of the gallery and the columns with provision for the column 18″x30″ panels. Fig. 9 is a view of the west end wall of the third floor laboratory showing the beam and slab reinforced concrete construction used throughout the building and brings attention to the fact that partitions are of pyrobar to be drilled, bored, or removed or changed in any way that the future may require. Fig. 10 shows the third floor hallway through the attic of the neck, also the columns on the third floor to support the roof slab and future roof house. This floor might be made into a single large room if occasion should ever require it. This flexibility of partitions is generally true for the whole building.

Grouping of Laboratories

Insofar as possible, the same kind of work is conducted on the same level. Class rooms are free from laboratory noises, so that laboratory work may be carried on at any time. Also, the lines of travel are so arranged that there may be no unnecessary travel through the laboratories.

Referring to Fig. 3. Rooms 5, 6, 7 and 8 are used for stock and shops for faculty, students and mechanics and are provided with full laboratory service for tests. Room 12 has its foundations independent of the building on the sub-basement floor, so that vibrations and noises of the service machines in the machine room may not affect tests in neighboring rooms. The storage battery room, 13, is provided with a ventilating shaft and is sealed from the other rooms.

The other rooms in the basement are intended particularly for research work, and measurements. Provision is made for placing tripod towers in the sub-basement and extending them through the basement floor for use in mounting instruments which may easily be affected by vibration.

The hallways are 12 feet wide and are for use as a public highway and for lockers. The cross hall to the elevator is limited to service only and is not expected to be used by students to enter or leave

Referring to Fig. 4, the head house on this floor is for departmental offices, offices, class rooms, laboratory service dark room and one photometer room. The general laboratory offices and cases for equipment records are provided for in the neck, which also contains one special dynamo machine laboratory to be used for any tests which may be done without noise. Rooms 103, 104 and 105 will generally be used as offices by instructors having work in the main laboratory, 107.

The main laboratory, 107, and the galleries, 207, of the second floor are for tests on a.c. and d.c. machinery. Cranes run the length of the room under the balcony on the south side and in the two-story middle portion. Instruments and equipment cases and the main switchboard and plug board are placed under the north gallery.

The second floor, Fig. 5, comprises the galleries already mentioned for use in light dynamo machine tests, exhibit setups, laboratory computing space and laboratory library, sophomore laboratory work and observational balcony for visitors. The neck contains small research laboratories and a design room, 208, having full laboratory service. The head house on this floor contains the departmental study and reading room. Room 210, used as a class room, is provided with a number of different kinds of illumination for demonstration and testing purposes. The photometer room, 214, is one of a tier of four rooms for different types of photometers.

Fig. 6, third floor, contains the lecture hall and equipment room, small class room and a photometer room. The attic of the neck provides storage space. The third floor of the laboratory wing is devoted to communication and, as shown, is about equally divided for the signal corps, broadcasting station, radio laboratories and telephone and telegraph lab-

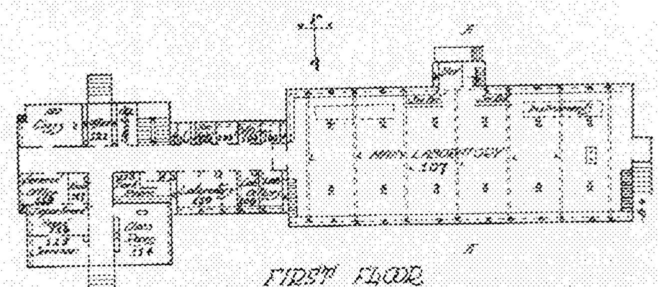


Fig. 4

oratories. Electric service for testing purposes in these rooms is controlled from the switchboard in Room 309.

Laboratory and Class Service

The primary object of a laboratory is the provision of equipment and service of all kinds in order that tests or experiments may be conducted efficiently. A large amount of flexibility is necessary in order that a wide variety of tests may be made in the same room. The demand for research service will fluctuate from time to time, also the growth along certain lines will likely be faster than in others, so that the rooms arranged en suite must vary. This may go to the point of changing the pyrobar partitions. The key system is designed so that any grouping of rooms as to use may be made without duplicating the keys. It should be evident that provision of proper service is even more important than the arrangement or grouping of rooms.

Of the various kinds of service, the following may be mentioned:

1. Heating, temperature control and lighting.

2. Instructor's location and signals.
3. Instruments, equipment and their housing.
4. Power service, wiring changes and additions.
5. Piping for gas, air, etc.
6. Common use of apparatus—transportation.
7. Lecture hall and class room service.
8. Repairs and shipping.

(1) Temperature control is supplied in all rooms by a standard thermostatic method. This protects apparatus from the bad effects resulting from wide temperature variations, insures greater accuracy in experiments and makes for comfort.

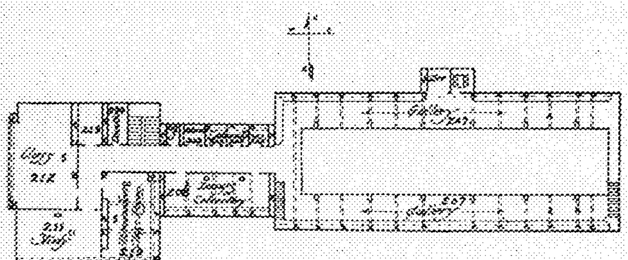
Each room is lighted by the most effective method for the particular purpose.

(2) In as far as possible, instructors have their offices adjacent to their major lines of work. Offices have telephones connected to the University telephone exchange. This gives both inside and outside service.

(3) In general instruments and equipment are housed or "homed" where most used. Each instrument is provided with a loan card signed "in" and "out" by whoever uses the instrument. Damages are reported to instructors in charge, who put the damaged apparatus in the proper channels for repairs.

All apparatus carried in the records is to be readily found by anyone interested at any time, whether in use or not.

(4) One of the worst, if not the most difficult, problems in such a building is the provision of satisfactory mechanical and electric power service. Mechanical power is supplied by electric motors where and whenever needed. Pulleys are bushed to a common size so that pulleys and brakes are interchangeable. For the electric power service for



SECOND FLOOR
Fig. 5

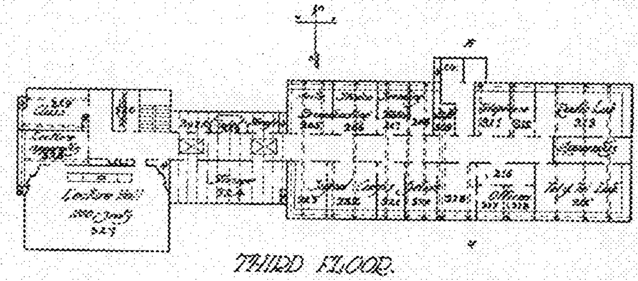
student tests and for research there is mounted on every pilaster in every room on all floors an asbestos wood panel, 18" high by 30", 28" or 24" long. Each panel carries switches, fuses and binding posts, so that 110-220 three phase, 110-220 single phase and 110-220 direct current may be always available. These are connected to the "tree-system" of wiring. On each panel there is in addition one or more plug circuits so that special sources of electric power may be plugged as desired.

Similar panels are mounted in each of the 12 columns in the main laboratory, provision for which is shown in the photograph of Fig. 8. Such panels, also, are mounted under each class or lecture table, and in the shops, altogether there being 150 test panels in the building.

These panels are black in color and are placed in all laboratories with their top lines 5' 9" from the floor.

As indicated in the section sketch of Fig. 2, wall benches, 24" net width, are placed on the outside walls under the panels. The benches are 40" high in the main laboratory and 32" high in all other laboratories.

Beneath the wall benches are trenches 12" by 6" deep, covered by removable dust-proof steel plates. These trenches connect with panel shafts or chimneys which run from top to bottom of the building on all pilasters. The trenches also connect with three tin pan tile spaces per pilaster, so that by the use of sleeves placed in the beams, runs may be



THIRD FLOOR
Fig. 6

made from the trenches to the 30"x30" wire raceways R. R. of Fig. 2 placed in the basement ceiling just outside the hallway. The two raceways interconnect at all points through the tin pan tile spaces across the hallway ceiling.

The raceways R. R. connect with the tangle space under the main switchboards as indicated in Fig. 2.

By omitting the grouting between floor sleepers, 2¼"x12" channels or "laterals" are made just under the wood floors and on top of the floor slabs. These "laterals" open into the wall trenches and are intended to be used primarily for semi-permanent setups when it would not be convenient to have loose wires lying about for a considerable length of time. Special fittings are used to bring the wires up through the floor. These "laterals" are indicated in dotted lines in the sketches.

The wall trenches, raceways and tangle room connect with seven wire shafts as well as with channels in columns and unused pipe channels and ventilation space. With the above system it is possible to run wires at any time, quickly and cheaply, anywhere in the building.

Service machines are placed in the machine room. These machines are generally remotely controlled from the main switchboard or from the communication switchboard in Room 309, so that the noises in any room are limited to those of the tests themselves and there is no interference by service machines.

Plug lines extending between the board of Room 309 and the main plug board shown at the west side of the elevator in Room 107 enable any kind of electric service to be delivered to any part of the building. For example, telephone research, with full third floor service as well as main switchboard service, may be conducted in one of the basement rooms.

The "tree system" is provided with circuit breakers for each main division of the laboratory.

The system of switchboards, panels, machine room and wiring is rather involved as to detail, but the results are simple and direct enough.

(5) The above shaft, trench and raceway system may also be used to run gas, air, water, etc., pipes to various laboratories as needed.

(6) In order to reduce duplication of equipment, all apparatus is made as portable as possible. Rheostats, starters, regulators and the like are mounted on racks having casters. Such apparatus is thus

(Continued on page 26)

SUPREME COURT CLEARS ENGINEERS

Indictment of War Contractors Annulled---Fees for "Cost Plus" Contracts Below Those for Other Work

By Julian R. Garzon, C. E. '24

IN November and December, 1922, and in January, 1923, the Government of the United States secured indictments against eleven contracting companies of the country for restitution of moneys alleged to have been wastefully and fraudulently expended on cantonment construction during the World War. The extent of the claims was $55,000,000.

This action by the government caused resentment by engineers all over the country because it was a blow directed against the entire engineering profession. When the indictments are read, it is seen that these charges cannot be sustained unless the acts charged were committed with the knowledge of all those connected with war construction work.

The principal allegation in the indictment rests primarily and essentially on the form of contract adopted by the government. The form used was not the same as the peace time form, it was a form drawn up by engineers and architects called to Washington by the government. The contract was based on the "cost of the work plus a sliding scale percentage with a maximum upset fee." In this contract greater cost did not mean a larger fee as is generally supposed. The gross fee paid on these contracts was less than three per cent and the net fee less than one per cent of the cost. These construction contracts carried a smaller fee than was paid in connection with any other contracts for war purposes by any other branch of the government.

Various committees were appointed by the government to look after the construction work. These committees were made up of the leading engineers and architects of the country. In March, 1918, the Talbot Committee was appointed by the War Department to review the method of conducting the construction work during the war and to advise with respect thereto. In June, 1918, the War Department appointed the Blossom Committee to review the construction work rendered necessary by the war. This committee found that the use of the emergency contract was justified and contributed to the speed of war construction programs and that such construction performance contributed materially to the success of the army operations.

Completion Was Imperative

The cantonments were all completed on time. They were started between June 13 and July 6, 1917. The completion of the cantonments was imperative in order that the men could be trained for the spring of 1918.

It is quite evident that the basis of these indictments was the findings of a congressional committee called the Graham Committee. The sub-committee consisted of Congressman McKenzie of Illinois and Congressman McCullough of Ohio, Republicans, and Congressman Demorus, Democrat, of Michigan. This committee divided on strictly party lines, making a Republican majority report and a Democrat minority report. The majority report found excess costs of cantonment construction based on the estimate made on one camp by one J. P. O'Connor, an Illinois contractor. They claimed the wide open contracting system was the cause of the excess costs and by a basis of comparison arrived at an excess cash cost of $78,531,521. On the 16 cantonments the minority report states that the system used was such as to keep the entire building program out of a state of chaos and had the program been conducted on any other basis the army would have suffered greatly during the cold winter of 1917. Furthermore that the Secretary of War was justified in this emergency in abandoning the usual peace time method of awarding contracts by competitive bidding and substituting the "cost plus" system of cantonment construction.

This is a brief review of the causes and facts of the actions brought by the Government. It is indeed a relief to the profession to have these charges wiped out by the court. The engineering profession is not a game of politics and politicians have been shown by this court action that the profession is not to be dragged into the mire of their game.

The following statement has been prepared by Mr. Max Galtz, of St. Paul, President of the Minnesota Federation of Architectural and Engineering Societies, for the purpose of calling the attention of the public to the final action in these cases.

THE TRUTH PREVAILS

Indictment Quashed By Supreme Court of the District of Columbia

The expected has happened in the case of the engineers indicted for conspiracy to control the construction program of the late war.

Judge Hoehling of the Supreme Court of the District of Columbia demolished the malicious and all embracing indictment with its implications of widespread criminality and graft that surrounds the indictment but which is justified neither by the facts nor by the specific charges. The decision is a complete vindication of the men so unjustly drawn into the meshes of a political persecution.

Judge Hoehling's analytical destruction of that indictment only confirms the self-evident falsity of the charges made against Benedict Crowell, Cleveland, later the assistant Secretary of War; C. W. Lundoff, contractor of Cleveland; William A. Starrett, an architect of New York, later a Colonel in the construction division of the army; Morton C. Tuttle, a contractor of Boston; John H. McGibbons of Chicago, a surety man; Clair Foster of New York, a contractor and later Major of Engineers; James A. Mears of New York, also a contractor.

Unfortunately, the news of misdoing travels faster and further than news of vindication. The whole engineering profession was besmirched by the charges against the men who devised our war construction program, not only because those men were respected members of the profession, but because what they did had been approved by committees of our technical societies. The charges have now been disproved, under the closest of judicial scrutiny, but their sinister effect will still go on.

(Continued on page 22)

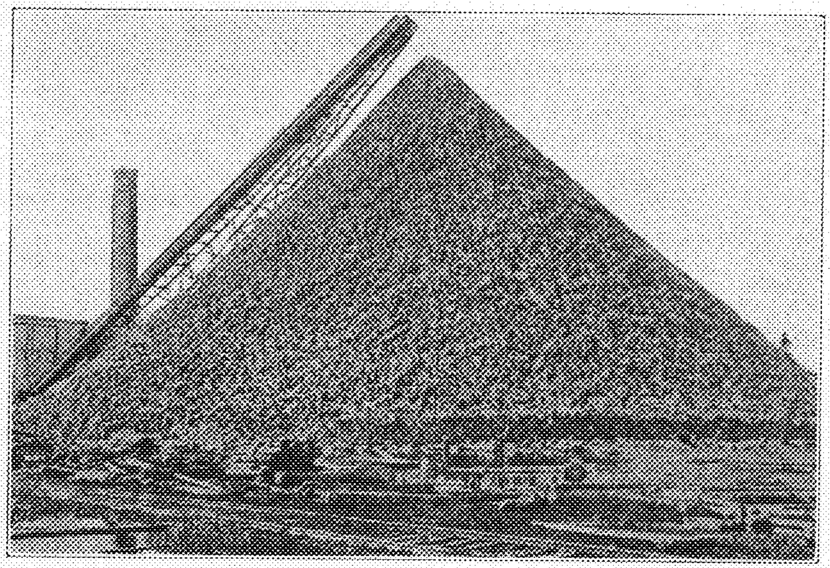
THE STORY OF NEWSPRINT PAPER

Restriction of Water Power Development Handicaps Industry In United States---Spruce, Poplar Used Extensively

By Adolph F. Meyer, Consulting Engineer
Formerly Associate Professor of Public Engineering, University of Minnesota

LITTLE do we realize, as we pick up our daily paper, how many chapters there are in the story of newsprint paper. Newsprint is made of wood, yet there is nothing in the printed sheet, even when we tear it and look at its fibers, to suggest the relatively hard, brittle character of a piece of timber or a wood splinter; nevertheless, these two are brothers to newsprint paper. How close this "blood relationship" is may best be expressed by saying that in the most highly developed process of manufacture today, newsprint paper consists almost entirely of mechanically ground wood—practically very fine wood slivers or splinters. Look at both sides of a newspaper sheet in a good light and you will be able to identify some sizable "slivers" by their shiny appearance. Only a small percentage of chemically digested wood fiber is added, and even this may be eliminated without detection by the unsuspecting reader.

The same species of tree that cheers our hearts on Christmas Day yields the best and most commonly used pulpwood—namely the spruce. Hemlock and balsam are also used in newsprint paper, particularly, however, for producing the small portion of chemically digested fiber used. Poplar is largely used for making pulp by the soda process.



Pulpwood Storage Pile—International Falls

It takes about two cords of wood to make one ton of chemically digested fiber. Only about one cord is required to produce a ton of mechanical or ground-wood pulp. About five or six million cords of wood are used in the United States each year in the making of all the different kinds of paper—newsprint, book, wrapping, etc. About a million cords of this wood is brought into the United States from Canada.

Water Power Development Restricted in U. S.

About one and one-half million tons of newsprint paper were made in the United States in 1920, and somewhat more than half as much in Canada. The Canadian production has doubled in six years, whereas newsprint production in the United States has increased comparatively little. Canada has fostered this industry, which ranks foremost in that country. The United States, on the other hand, by restricting the development of water power, particularly between the years 1908 and 1919, has handicapped the paper industry. The significance of this statement is better appreciated when we realize that it takes about 100 horsepower, exerted continuously for twenty-four hours, to produce a ton of newsprint paper. Cheap power is essential to low cost production of practically all kinds of paper, but it is particularly true with respect to the production of newsprint and wrapping papers. It requires about seventy continuous horse-power for one day merely to grind one ton of pulp used for newsprint, without considering all the power required for running the machinery of the mill.

Ground-wood on the Price Toboggan

During 1920, the price of ground-wood pulp reached the high point of $150 a ton. The average price before the war was about $25 a ton. In 1921 the price dropped back again almost to the same level, but there were practically no sales because ground-wood pulp could not be sold at that price. During 1922 and 1923 the price of ground-wood was about $35 a ton.

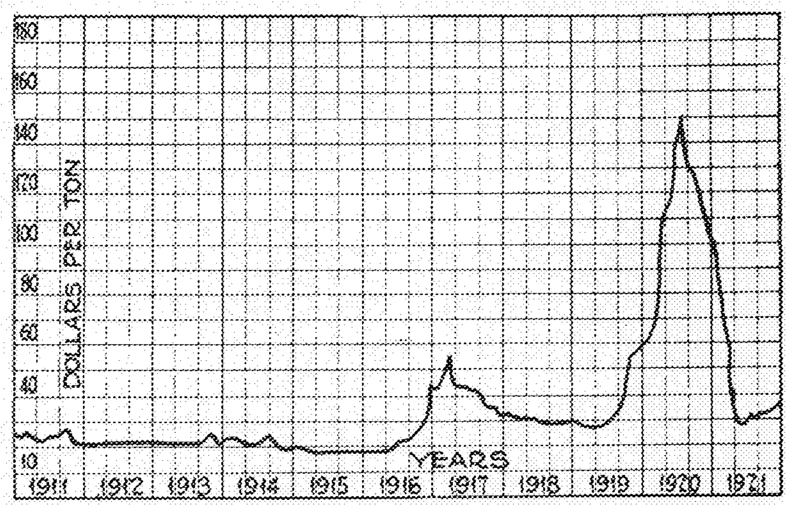
Newsprint consists of about 80% of ground-wood and 20% of a chemically digested fiber known as "sulphite." The best brown wrapping papers consist entirely of a chemically digested fiber known as "kraft" or "sulphate" pulp. Although no power is used for mechanically grinding wood for wrapping paper, a great deal of power is required for the proper preparation, by what is known as "beating" of the chemically digested wood.

Sulphate pulp is the strongest known wood pulp. It makes a paper about four times as strong as newsprint of equal thickness.

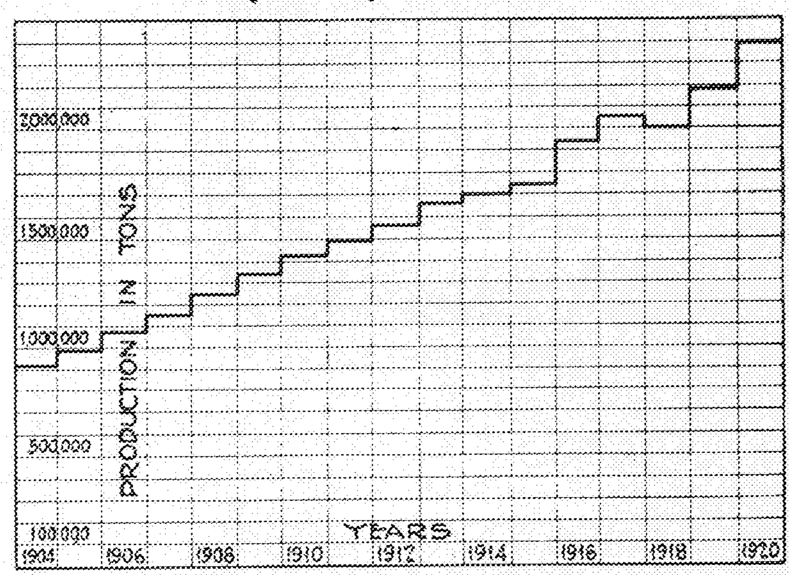
At the present time, the Western manufacturers are using spruce logs up to five and six feet in diameter for pulpwood. In the East and in the Middle West, such timber is sent to the saw-mill instead. Only the smaller sizes, running from three or four inches up to twelve or fifteen inches in diameter, are used for pulp in these regions. Larger trees are cut into saw-logs.

Pulpwood is taken from the forest to the mills by rail and water, usually in the form of four, eight or sixteen-foot logs. Four-foot wood, particularly in Canada, is often peeled in the woods. On reaching the mill, pulpwood is usually sawed into two-foot and four-foot lengths. Part of the wood is used immediately and the remainder is usually stored in large cone-shaped piles that resemble miniature mountain peaks. These piles are often more than a hundred feet high and contain twenty or thirty thousand cords of wood. Pulpwood stored in such piles must be used within two or three years or it will deteriorate very seriously, as these large piles heat up and decay.

The rough pulpwood is taken by conveyors either from the streams, the railroad cars, or from the storage pile, to large rotating drums or to knife-barkers to have the bark removed. The barking drums are about ten feet in diameter and thirty feet long. They are set in vats containing water. The drums are rotated slowly by means of gear or chain drives. Wood is fed into one end of them and comes out barked at the other end. Pieces not completely barked are returned to the drum. By this process, very little good wood fiber is wasted. The bark is pressed to remove most of the water and burned under boilers or refined and used in the manufacture of building papers or insulating board. The knife-barkers waste a great deal of good wood fiber and are dangerous to operate. A great many men have lost fingers in the knife-barkers. The bark from these machines being dry has large fuel value, and is almost invariably used for that purpose.



GROUNDWOOD PULP
AVERAGE PRICES 1911-1921



NEWSPRINT PRODUCTION
UNITED STATES & CANADA

Making Sulphite Pulp

After the bark has been removed from the wood and the pieces are thoroughly washed, part of the wood travels by chain conveyor to the grinder-room to be mechanically ground, and part goes into machines known as "chippers," which cut about ¾-inch slices in rapid succession from the ends of the sticks, much as one cuts slices of bread. The knives are placed on large, heavy rotating disks and they cut the wood at an angle with the grain rather than square across. The slices of wood break up into smaller pieces immediately, because the blades of the knives that do the cutting are necessarily very heavy. These "chips" are carried on belt conveyors to rotating screens where both sawdust and the larger pieces are removed. The sawdust goes to the boilers to be burned and the larger pieces are sent to "crushers" somewhat similar to the cylinders of a grain separator, except that the teeth of these chip crushers are loosely hung instead of being rigidly supported. The teeth are thrown outward by the high rotating speed of the crusher and exert a whipping action on the chips as they pass through the stationary teeth of the bed plate of the crusher. This breaks up the chipped wood further, so that after it gets to the screen again, only a few long slivers are rejected.

In the making of sulphite pulp for use in newsprint, these chips are cooked in large brick-lined metal boilers through the action of steam and sulphurous acid. This cooking acid is prepared by burning sulphur and leading the gas through lime water, which absorbs it. It takes about eight or ten hours to cook a digester full of chips. When the cooking has been completed, the charge is blown from the digester by steam pressure into a large pit which has a porous tiled floor. During the blowing of the digester, large clouds of steam with the characteristic sulphur smell belch forth from these blowpits through short stacks known as "vomits." In the "blowpits" the pulp is washed with warm water to remove any unspent cooking acid. It is next screened to remove knots and uncooked chips. Except for the water in it, the pulp is now almost as fluffy as cotton and of a very pale, almost white, color. It is used in this form for newsprint, but for fine book papers, the sulphite fiber is further whitened by bleaching with hypochlorite or ordinary bleaching powder.

The wood which has been sent to the grinder-room after being barked is ground on large enclosed grindstones resembling those used for sharpening tools, but of coarser grit. The sticks are placed in pockets and held against the grindstones by hydraulic pressure. They are placed flat-wise and not end-

(Continued on page 28)

HIGH SCREEN EFFICIENCY SECURED

Tests by Minnesota Student Show Higher Development Than Reported by Other Similar Installations

By A. W. Morse, E. E. '25

TESTS in screen projection work recently conducted at the University of Minnesota by Chauncey L. Greene, senior electrical engineering student, have shown results indicating the large field of development still ahead in the motion picture industry. By the application of the principles illustrated through this investigation, movie fans will be spared the eye strain and resulting headaches which occasionally follow an evening at the theater.

The result of Greene's work proves the correctness of the theories which he has followed in the operation of the machine provided by the University authorities for film work in the engineering auditorium. These principles, however, apply to every motion picture theater, and their proper interpretation and use elsewhere would add greatly to the comfort of the public and the profits of the theater owners.

It is well known in the projection industry that the larger pictures require more light. The several theaters in Minneapolis which throw pictures upon the screen in dimensions of from 16½x12¼ feet to 24x18 feet need the full effect of every ampere of current in order to eliminate as many of the defects of reproduction as possible. Not very long ago, pictures were shown in Australia in sizes ranging up to 36x27 feet, but experience has proven the inexpediency of this practice.

In theaters where the smaller sizes of pictures are used, the amount of current used in the projection machine can likewise be diminished, if the lens systems are efficient. And here is where the pocketbook of the owner is directly affected.

How the Arc Light Works

The working hypothesis accepted as authentic in regard to the ordinary carbon electric arc is that as the arc current is increased from a low to a high value, the area of the surface which is incandescent on the positive carbon (the crater) becomes larger. And as the crater enlarges, the current density at this point does not increase until practically all the available surface on the carbon is occupied. Then, when the crater area can no longer enlarge, the increase in arc current necessarily causes an increase in density. It is assumed that the floor of the crater is composed of a thin layer of boiling carbon, which is the source of the screen light. The hotter the carbon, the brighter the arc becomes. The higher the temperature, the shorter the waves emanating therefrom and hence the more the light. But apparently the combustion ceases at the boiling point of the carbon and vaporization occurs at this temperature, which is about 3,500 degrees centigrade.

Apparatus used by Greene in his tests on February 18, 1924, consisted of a screen of 91 square feet, the moving picture machine and a photometer.

(With Greene at the photometer and O. S. Keay at the arc):

Arc Current in Amperes	Photometer Readings Light in Foot-Candles	Light From Each Ampere Lumens per Ampere
22.25	7.0	28.6
27.5	13.0	43.0
30.5	15.2	45.2
35.0	17.3	45.0

(With O. S. Keay at the photometer and Greene at the arc):

25.5	11.85	42.4
30.0	15.62	47.4 (high value)
33.0	15.45	42.6
40.0	17.5	39.7

Regarding the results of his tests, Greene said, "The accepted theory of the arc has always embodied the statement that the crater was boiling carbon, and hence that its temperature and intrinsic brilliancy were fixed. The results obtained in these efficiency tests in no way contradict this theory, but rather seem to limit it to a range of energy concentration in the crater considerably above that in most common use."

Greene explained the noticeable increase in light obtained in the space intervening between 22.25 and 25.5 amperes by the theory that volatilization commences to take place when the current density increases beyond a certain point.

These readings are higher by far than any recorded from any other theatrical carbon arc installation in the United States, though they have been equaled by Dr. E. Leon Chaffee in the Cruft high tension laboratory at Harvard. The highest theatrical screen efficiency of which record has been obtained by Greene is at the Nokomis theater in Minneapolis, where 34.7 lumens per ampere are obtained. The best results are obtained where the distance from the machine to the screen is not less than 4½ times and not more than 9 times the picture width. The distance used at Minnesota is 4.4 times the picture width, and at the Nokomis theater it is 5 times the picture width.

One of the pioneers of the projection business, John Griffiths, of Ansonia, Connecticut, determined a theory or lens system about nine years ago, and this theory still stands uncontradicted. Griffiths based his theory upon the assumption that the beam diverged in space where previously it had been thought to converge. His lens charts provided for uniform illumination of film and utilization of the maximum amount of divergent ray.

Using High Power Lights

In 1916 Greene entered the field, and at that time a 60-ampere arc was considered enormous. Then 60 amperes became common; 75 was used for some time; 80 was not infrequently met; before long, 90 was heard of; and finally 125 seemed to be the limit. Beyond 125 amperes, an increase in arc current was without effect on the screen. So the limit of 125 amperes caused a limit to brilliancy and the size of

(Continued on page 27)

THE 1924 A. C. E. CONVENTION

Minnesota Entertains National Delegates---All-Engineer Dance Winds Up Three Day Stay Here

By Herbert Liese, C. E. '24

The annual national convention of the Association of Collegiate Engineers came to Minnesota on February 14, 15 and 16. It was held for the most part in the Auditorium of the Main Engineering Building under the auspices of the Technical Association, which is composed of the A. S., C. E., A. S. M. E., A. I. E. E., and similar organizations in the schools of architecture and chemistry. Mr. P. L. Bergquist, national vice-president of the A. C. E., was in charge of the arrangements for the convention.

The purpose of the A. C. E. is to foster a better spirit of friendship and brotherhood among the student engineers of the country, and also to act as a link connecting the student to the profession as a whole. One of the traditions that the A. C. E. is trying to perpetuate is the celebration of St. Patrick's Day in the technical colleges of the country. It will be remembered that the first celebration was held at University of Missouri, in 1902, and in schools like Minnesota it is one of the big events of the year.

The following schools are at present represented in the A. C. E.:

- University of Missouri
- University of Minnesota
- Oklahoma A. & M.
- Washington University (St. Louis)
- Missouri School of Mines
- University of Tennessee
- University of Arkansas
- University of Nebraska
- University of Oklahoma
- University of Kentucky
- Iowa State College (Ames)
- Colorado School of Mines

Each of the above schools, except the last three, sent at least one delegate.

The first meeting was called to order at 10:30 a. m., Thursday, February 14th, by George A. Heap, of the University of Oklahoma, president of the A. C. E. for the past year. Committees were assigned to discuss and report on the various items of business brought before the convention. The meetings lasted throughout Thursday and Friday and the following business was taken up in the order given: The election of the University of Missouri Queen of St. Patrick for the coming St. Patrick's Day (this duty, or shall we say privilege, is one of the functions of the convention); the report of the committee on the publication of the organization; that of the committee in regard to the expansion of the organization; that of the committee on amendments; that of the committee on finance; reading of the minutes of the previous convention, held at the University of Oklahoma; report of the committee discussing the matter of withdrawal of chapters; that of the matter of national dues; general discussion; place of the next convention decided; report of the resolutions committee; and the election of officers for the following year. Other matters of no little importance included a proposition concerning the state licensing of engineers, to be presented to the state legislature, and the establishment of a placement bureau at the different technical schools in conjunction with the faculty for the purpose of placing graduate engineers in good positions. The convention adjourned at 5:30 Friday afternoon.

The next year's convention will be held at the University of Missouri and the president for the coming year will be George E. Edscorn, of the University of Missouri. The national vice-president is elected by the technical societies of the school where the coming convention is to be held, and the national secretary is permanently elected from the University of Missouri.

The convention was ably handled by Mr. Bergquist, who saw to it that the delegates were well taken care of and royally entertained. On Thursday evening an All-Engineering Smoker was held at the Engineering Auditorium, under the direction of the Electricals. An attempt was made to have all the senior engineers bring their freshman advisees for the purpose of getting acquainted. Some novel entertainment was furnished in the form of a solo dance by one of our own co-eds, which leads us to wonder if Lyle McLeland has squared himself as yet. On Friday evening those delegates who were willing to brave our northern climate went to the Hippodrome to witness St. Paul beat Minneapolis at hockey. The remainder of the body of delegates went to the Hennepin-Orpheum. The Chemists had charge of this entertainment. On Saturday morning an inspection trip of the campus was made, which, at present holds much of interest to the engineer, and on Saturday afternoon cars were furnished by the Architects to transport the delegates through the Twin Cities on a sight-seeing trip, which took in much of the new construction that is now going on. The crowning event of the day was the All-Engineering Dance on Saturday evening at the Minnesota Union ball room, under the auspices of the Civils. The features were novel and most interesting—with gestures.

The housing of the delegates during their stay was in charge of the Mechanicals. The delegates were assigned to six different professional and academic fraternities in proportion to their accommodations.

Much interest was inspired by the convention here, and it is to be hoped that Minnesota has more national conventions of this sort, because of our unusual ability to accommodate them.

FAIRY STORY

Willy—Pa, will you please tell a fairy story?

Pa—A fairy story? Well, let's see, how will we begin it?

Ma (sweetly)—Begin it, "I was detained at the office, dear," and then continue.

WAS HALF DEAD

Mrs. Cohen—Dis life guard saved your life, Cohen. Shall I giff him a dollar?

Mr. Cohen—I was half deadt ven he pulled me out. Giff him only fifty cents.

AS A WESTERNER SEES NEW YORK

"Red Book" Furnishes General Lines to Location of House Numbers---Ghetto Only Famous Locality Left

By E. C. Manderfeld, E. E. '21, '23

IS New York the port of your dreams? Or do you feel it is the best place in the world to keep away from? There is an argument on either side of both questions. Since the city is so large, you can live your own life in it, and no one will know or seem to care what you do. New York seems rather cold, yet a newcomer will find little trouble in making desirable acquaintances. From an intellectual standpoint, New York offers more opportunities for culture than one can take advantage of. People who have lived here for a considerable time think New York is The Only city in the country. What lies behind the glamor? As a Westerner, I shall try to give a few of my personal impressions of the big city.

When I was a student at Minnesota, I really never had very much curiosity about this city and even less desire to locate here permanently. But Fate plays a peculiar game, so one nice, bright morning in the latter part of August found me walking out of the Grand Central Station gazing upon New York. I noticed the hurry and bustle of the crowds and the congested traffic and then I was given my first surprise. Coming down the avenue was a diminutive street car (surface cars as they are known here). The motorman had no use for a bell as the car by its noise announced itself. This sight seemed rather humorous. Here I was in the largest and probably the richest city in the world, where one would naturally expect the latest and most efficient methods in transportation, yet the street cars were unmistakably of the nineteenth century type.

This was my entrance. I've been here now for a few months and have seen a few more things of interest. Some of them have impressed me as very good, whereas others have sometimes shocked me. However, every locality in the world, I presume, has some good and some bad features and New York is no exception.

A City of Villages

New York, I believe, can be described briefly as a city composed of villages. There is no definite street system, avenues and streets running in every conceivable direction. One particular street I've discovered, called Pearl Street, nearly meets itself; that is, it has the general shape of a horseshoe. Another street called Fourth Street crosses Twelfth Street. Part of New York known as Manhattan is divided by Fifth Avenue into two sections, known as East Side and West Side. Yet there is no particular similarity between house numbers located on the West Side as compared with those on the East Side. This is due to the fact that the avenues do not all begin on the same latitudinal level. The beginning of two adjacent and parallel avenues may be four blocks apart but the house numbers were assigned by simply numbering from the beginning and continuing to the end. This non-uniformity is bad, as practically the only way to locate a particular address is to get a guide book known as "Red Book" and find out the general location of the particular place for which one is searching.

Another evidence of villages is the general appearance of a great number of the older buildings and streets. Here one can still find the houses built up to the sidewalks with the steps leading directly to the door. Some of these have the old-fashioned brass knocker. The sidewalks are generally narrow and in a rather poor condition. Many of the walks are constructed from big slabs of stone instead of concrete. As a matter of fact for some unaccountable reason a lot of construction work is done in this city using mostly stone instead of reinforced concrete. I've noticed a few new apartment houses which were in the process of construction, all of which had stone foundations. This in the light of high labor costs seems a very poor method of building construction, but probably there are other items which make the stone construction more desirable. Many of the street pavements are also built of stone. This is desirable, though, because stone pavements seem to bear up better and longer under heavy traffic than the ordinary asphalt or wood block pavement.

The Bohemian Quarter

While we are on the subject of villages, let me say a few words about one village for which New York is famous. This is Greenwich Village and is known throughout the United States. This place a number of years ago was the gathering place of the artists and bohemians who drifted into New York. Apparently this district located in the heart of the city has undergone very little physical change. The streets run in many directions. It contains many little stores, cafes, novelty shops and studio apartments. At present very few real artists live in this section, but inasmuch as so many stories have been written about it, it still is a drawing attraction to visitors and also to those people who consider themselves somewhat bohemian. As a matter of fact, I think Greenwich Village has nearly ceased to exist and is, as stated by a prominent clergyman, "merely a state of mind." Its ancient and dilapidated condition seems to add a romantic setting for a certain sentiment-loving class of people and the present residents of the village are not slow in catering to this class. So as a consequence there are a lot of basement stores, cafes, such as the "Pirates' Den," "Jolly Friars," "The Mad Hatter," and a host of others which apparently are the seats of adventure and excitement but in reality are quite law-abiding and orthodox.

There are a few more famous localities in New York City such as the Bowery, Chinatown and Ghetto. The Bowery, in the olden days, was considered the most criminal and toughest community of the country. But at present it is peaceful and quiet, thanks to more efficient police supervision. Chinatown is also an article of imagination rather than of reality. About the only people who are vitally interested in this place are the operators of the sight-seeing busses.

The Ghetto is the home of the lower class of foreign population. It is a place hard to describe. It

(Continued on page 26)

ALUMNI NEWS

In the hope that we can locate a number of "lost" engineers, we will publish a list of names in each issue of the Techno-Log. These are names of men who have changed their mail address and of whom we have no location record. The Techno-Log and the dean's office are desirous of keeping a complete and up-to-date record of our alumni. If you have any knowledge concerning these men you are urged to send it to the alumni editor of the Techno-Log.

Electricals

Lyman D. Taylor
George W. Uzzell
Theodore Vita
Frederick Von Schlegell

Mechanicals

Maurice D. Bell
Frederick W. Buck
Paul S. Buhl
Richard F. Cox
Harry S. Dresser
Charles E. Holmgren
Benj. W. Loye
Carl C. Muller
Otis S. Nelson
Harold T. Odegaard
Oscar A. Olstad
Leo E. Owens
A. E. Ruemmele
Ralph G. Taylor
Frank Umbehacker
Elias C. Wennerlund
Royden V. Wright

General Engineering

Nathan Harris
Joseph E. Young
George B. Deane
Elmer Ellingson

1923 CIVILS

Arne Aasland is with Harrison & Smith, printers, in Minneapolis.

L. W. Aldrich is working for the city engineer, San Bernardino, Cal.

R. Bergford and **Mr. Meskal** are with the Minnesota State Highway Commission.

F. B. Christlieb is with the Fairbanks-Morse Company in St. Paul.

J. Darrell is in Chippewa Falls, Wis., with the Northern States Power Company.

P. R. DeFreece works for Siems, Helmers & Schaffner.

E. C. Dindorf is with the Truscon Steel Co., of Minneapolis.

Mail will reach **G. Guesmer** and **H. J. Manger** at Chippewa Falls, Wis.

The Coast and Geodetic Survey bulletin of January 31 announces the confirmation by the U. S. Senate of the commission of **Hibbert M. Hill**, Civil '23, as Junior Hydraulic and Geodetic Engineer. Mr. Hill has recently been engaged in a special survey of a portion of the Lake of the Woods during January. The work was done on the ice.

A. W. Johnson can be reached at the Truscon Steel Company, Youngstown, Ohio.

Maurice D. Judd, C. E. '23, is estimating structural steel and iron in the contracting department of the St. Paul Foundry Co. He is living at 2718 Garfield Ave. S., Minneapolis. Judd is a member of Alpha Sigma Phi and Xi Epsilon.

Glen Nelson is doing subdivision work at Long Beach, Cal.

E. J. Olson lives at 1020 N. E. 4th street, Minneapolis.

J. J. Schlenk is in Fond du Lac working for the Phoenix Utility Company, of Duluth.

A. Sclarow lives at 1402 8th avenue north.

Elmer A. Nelson is assistant engineer in the bridge department of the C. A. P. Turner Company, consulting engineers. Mr. Nelson belongs to the Minneapolis Engineers Club, and A. A. E. His address is 820 21st Avenue south.

Lloyd A. Peck lives at 102 Madeline street, Joliet, Ill. He is a draftsman working for the E. J. & E. Ry. Co. Peck is a member of Tau Beta Pi, Xi Epsilon, and Alpha Sigma Phi.

George Schaller, 3347 Aldrich avenue south, Minneapolis, is now with the Minnesota State Highway Department as a field draftsman. Formerly Mr. Schaller was employed by the N. P. Ry Co. as a rodman at Duluth. Schaller is a member of Theta Xi and Plumb Bob.

R. D. Spencer is with the California Highway Commission, Division VIII, at San Bernardino, California. Spencer is a member of Theta Tau fraternity.

Harry W. Abramson, C. E. '23, is working as Junior Testing Engineer for the Illinois State Highway Department at Springfield, Ill.

From June to August, **Swan P. Berg**, C. E. '23, was working with the Concrete Steel Co. as draftsman. Since that time he has been employed on bridge and ore dock design for the Soo Line Ry.

Byron K. Curry, C. E. '23, was working for the Sandusky Cement Company at Dixon, Ill. He was making a topographic map of the quarry, and was locating test holes. Since then he has been working on the Ford plant. While in school, Curry was an active member of Plumb Bob.

Nels Johnson, C. E. '23, is working for the M. St. P. & S. Ste. M. Ry Co. From May to November, 1923, Nels was detailing for the Corrugated Bar Co., Inc.

A. A. Sauer, C. E. '23, is drafting for Toltz, King & Day, Inc., of St. Paul.

O. H. Hosmer, C. E. '23, is Assistant Civil Engineer in the City Planning Department of St. Paul.

Walter L. Kotz, 415 Marshall avenue, St. Paul, is a computer with the Great Northern Railway Co.

M. W. Lazerowitz and **E. Thompson** are in the structural drafting department of the Minneapolis Steel & Machinery Co. Lazerowitz is a member of A. A. E.

Walter L. Maiser, 886 18th Ave. S. E., is in the legal valuation division of the Great Northern Ry. Co.

Lloyd S. Mitchell has been following the trades of laborer, foreman of construction, engineer, and estimator for Ward & Weighton, contractors. His address is 510 Davidson building, Sioux City, Ia. Mitchell is a Plumb Bob and a member of Phi Sigma Kappa.

R. H. Flindt, 3034 Lyndale Avenue north, Minneapolis, is assistant engineer for Croft & Boerner, architects and engineers. He is a member of A. A. E.

Carl H. Tennstrom, 1112½ East Second street, Duluth, is with the Phoenix Utility Co.

Walter Villaume is a designer and draftsman with the E. J. & E. Ry. Co. at Joliet, Ill. His address is 103 Buel avenue, Joliet. He is a member of Alpha Sigma Phi.

Arthur C. Zimmerman is now with the U. S. Coast and Geodetic Survey, Washington, D. C., as a deck officer. He was formerly employed by the Great Northern Railway Co. as a computer in the valuation department.

1923 CHEMISTS

Lloyd Hatch is chemical engineer at the Minnesota Mining & Mfg. Co., St. Paul.

Ross Bostwick is working in a paper plant at Vancouver, Washington.

Clifford Peterson is working for the Goodrich Linseed Oil Company at Milwaukee.

Hubert Fredrickson and **Edmund Kampa** are wtih the Empire State Oil Company, Bartlesville, Okla.

Charles V. Firth is with the Mines Experiment Station.

E. L. McMillan is doing graduate work in the Department of Chemical Engineering, and assisting in that department also.

P. M. Paulson is doing research in chemical engineering. He holds the Engineering Experiment Station Fellowship.

D. E. Edgar is doing graduate work under Dr. Frankforter. He is also assisting in the Department of Organic Chemistry.

Ben E. Sorenson is doing graduate work in chemical engineering, and assisting in Technological Chemistry.

Lester Eck and **Robert White** are doing graduate work in chemical engineering and assisting in the Department of Inorganic Chemistry.

Richard Rademacher is doing graduate work in Chemical Engineering.

W. S. Anderson is in Raleigh, N. C., instructing in the chemistry department of the North Carolina State College.

A. C. Bakken is with the Aluminum Co. of America, New Kensington, Pa.

J. O. Barrett is working for the City Waterworks, St. Paul, Minn.

N. S. Cassel is with Procter & Gamble Co., Ivorydale, O.

R. Chadbourne's address is Apt. 458, Curtis hotel, Minneapolis.

R. C. Ernst is an instructor in the school of chemistry.

H. O. Halvorson is a teaching fellow, department of bacteriology, University of Minnesota.

Ernest Gester is in the chemistry department, Northwestern University, Evanston, Ill.

William T. Morin lives at 615 West Wilson avenue. Glendale, California.

L. F. Stone assists in the chemistry department at the University of Minnesota. He lives at 613 Oak street southeast.

William Thordarson is doing graduate work. His address is 983 18th avenue southeast.

Cora H. Webster is back at Minnesota doing graduate work also. Her address is 3008 Fremont avenue south.

L. Wyman is an instructor in the Oklahoma School of Mines.

1923 ARCHITECTS

W. A. Backstrom lives at 827 21st avenue south, Minneapolis.

J. A. Walquist and **E. V. Nielson** are with Lang, Raugland & Lewis, 412 Essex building, Minneapolis.

T. L. Sime is with Colburn & Forsell, architects, 210 South 9th street.

A. Strom lives at 4522 North Ashland avenue, Chicago, Ill.

C. H. Luedeman was the first man to get a B.S. in architectural engineering. He is working for Holabird and Roche, architects, of Chicago, Ill.

Edward O. Holien, 1030 Broadway street, Fargo, N. D., is an instructor in architecture in the North Dakota Agriculture College at Fargo. He is a member of Tau Sigma Delta and Alpha Rho Chi. Mr. Holien was a Moorman prize scholar at Minnesota.

E. L. Johnson, 1020 9th avenue, Huntington, W. Va., is a draughtsman for Robert L. Day and Sidney L. Day, architects, of Huntington. He is a member of Tau Sigma Delta and Tau Beta Pi. Mr. Johnson's home is at Nelson, Minn.

Miner J. Markuson, Virginia Polytechnic Institute, Blacksburg, Va., has been employed since August, 1923, as an instructor in rural architecture, drawing and surveying in the department of agricultural engineering. He is also an extension specialist in farm buildings, which includes the making of plans and supervising the demonstration work in farm buildings and farmstead planning for the entire state of Virginia. Mr. Markuson's home is in Madison, Minn.

1923 MINERS

Alfred T. Anderson, 300 Pine St., Anaconda, Mont., is in the Research Department of the Anaconda Copper Co.

John N. Brawley, 829 Goodrich Ave., St. Paul, is a machinist in the South Park Foundry & Machinery Co.

Walter W. Brenner, Butte, Mont., is mining in the Black Rock Mine.

Robert A. Calhoun, Box 5, Dividend, Utah, is mining and sampling for the Tintic Standard.

Fred D. DeVaney, 312 17th Ave., Tuscaloosa, Ala., has a research scholarship at the University of Alabama. His investigation is in iron ore concentration.

Harry C. Dinmore, 324 Faneuil St., Brighton, Mass., is a special agent for the Underwriters Association. He has been inspecting electrical equipment.

Chas. P. Erdman, 612 9th Ave. S. E., Minneapolis, is doing some post graduate work in Geology at the University of Minnesota.

Arthur C. Erickson, 306 N. 5th Ave. W., Virginia, Minn., is an engineer for the Oliver Iron Mining Co., at Virginia.

Adolph L. Foss, Box 476, Ramsay, Mich., is assistant mining engineer and geologist for the Castile Mining Co.

Arthur J. Friedl, 399 N. Hill St., Pasadena, Cal., is recuperating from an operation and doing well.

Luke J. Gallagher is in Faribault, Minn.

Alex M. Gow, 1320 S. E. 7th St., Minneapolis, is a Technical Investigator at the Minnesota Mines Experiment Station.

Willis R. Griswold, Lancaster, Pa., is an engineer for J. C. Barr.

Gordon B. Jeffers has a scholarship at the School of Mines of the University of Washington, Seattle, Wash.

Verne L. Kegler, Isabella, Tenn., is a mining engineer and geologist for the Ducktown Sulphur and Copper Mining Co.

Shou Kun Kwong is taking some graduate work in coal mining at the University of West Virginia, Williamstown, W. Va.

Henri E. LaTendresse is on his way to Belgian Congo, where he will do mining and prospecting work for Forminiere.

Julian H. Levy is in the Testing Department of the Illinois State Highway at Springfield, Ill.

Richard J. Lilly is an instructor in Geology at Williams College, Williamstown, Mass.

O. William Lundquist, Babbitt, Minn., is outside engineer for the Mesaba Iron Co.

John L. Middleton, Forminiere, Mission Butler, Amadi (Haute-Uele), Congo Belge (Faire Suivre), is hunting for diamonds and gold in South Africa.

Frank E. Mooney, Gary, Indiana, is in the open hearth department of the U. S. Steel Corporation mills.

Henery A. Pabst, Hibbing, Minn., is pit engineer at the Mahoning Mine.

Robert W. Pearsons is a sales engineer for the Ingersol-Rand Co. at Phillipsburg, N. J.

Roland B. Queneau, Palmerton, Pa., is with the New Jersey Zinc Co.

Robert H. Ridgway, 1905 Stevens Ave. S., Minneapolis, is a Technical Investigator at the Minnesota Mines Experiment Station.

Chas. B. Russell, Reedsville, W. Va., is a mining engineer for the Bethlehem Mines Co.

Adolph J. Scheid, 137 Sycamore St., Milwaukee, Wis., is with the Columbia Tool Steel Co.

John N. Searles is assistant county engineer at Mazeppa, Minn.

Anthony O. Sjolinder, Mandan, N. D., is in the engineering department of the N. P. R. R.

Clifford H. Swenson, Reedsville, W. Va., is a mining engineer for the Bethlehem Mines Co.

Herbert E. Thellin, Crosby, Minn., is assistant city engineer of Crosby.

Everett H. Tollefson, 2729 Girard Ave. S., Minneapolis, is an instructor in drawing at the University of Minnesota.

Edgar W. Vivian, Hibbing, Minn., is pit engineer for the O. I. M. Co., at the Mahoning Mine.

Fred H. Wilcox, 2117 Kenwood Pkwy., Minneapolis, is in the Geology Department of the N. P. R. R. and has been in North Dakota most of the time since graduation.

William M. Winter, Olivia, Minn., is outside engineer for Kircher Bros., contractors.

Donald H. Wolfer, Shelby, Mont., is a geologist for the Campbell Oil Co.

Harry M. Wrbitzky, Peoria, Ill., is a highway engineer for the Illinois Highway.

George Hezzelwood, Dividend, Utah, is sampler and geologist for the Tintic Standard.

A. C. Zimmerman, C. E. '23, stopped over in Minneapolis for five days, leaving at noon, March 5, for Seattle, to report to his ship, the "Surveyor." The boat is 188 feet long, and carries nine surveying officers and a crew of sixty men. It is doing inshore and deep sea sounding, wire drag work and shore topography. Zimmerman's address is 202 Burke Building, Seattle, Wash., care of U. S. C. & G. S. Steamer "Surveyor."

1923 MECHANICALS

An interesting letter was recently received from **Ralph W. Ransom**, M. E. '23, who is doing general engineering work for the John Morrell Packing Co., at Sioux Falls,

S. D. Mr. Ransom has a responsible position for a young engineer, and is often obliged to give definite decisions on important matters, some of which, he writes, are rather far fetched. Mr. Ransom was quite active while at the University and in his letter he incidentally gives an alumnus' viewpoint on school activities which might be an inspiration to the undergraduates. He writes, "I only wish I had done more while at school and could help again. One can always look back over a past period and see much more in it than was evident at the time."

Grant C. Bergsland, M. E. '23, has been working for the Wisconsin Railway Light and Power Co., at La Crosse, Wis., since graduation. That he is making a success of his work is shown by the fact that in December he was appointed master mechanic of shops at La Crosse. His address is care of Y. M. C. A., La Crosse, Wisconsin.

Delton Waby, M. E. '23, and **Harold Messer**, M. E. '23, are just finishing a power plant training course which they are taking at the Central Stations Institute of Chicago, Ill. Mr. Messer was married soon after graduation.

S. H. Acker is with the Great Northern Dynamometer Car., St. Paul, Minn.

R. C. Ascher's address is care of Lackawana Club, Lackawana, N. Y.

E. V. Brossard and **H. E. Peckham** are with the St. Paul Gas Light Co.

We have only the addresses of the following men:

F. E. Copeland, 2591 West 7th street, St. Paul.
R. E. Gross, 581 Portland avenue, St. Paul.
E. H. Eige, 227 West 33d, Minneapolis.
A. Gilstad, Route 2, White Bear, Minn.
H. O. Halden, care of H. E. Beebe, Duluth, Minn.
A. W. Sear, 432 Clement street, Milwaukee, Wis.

S. S. Hibbard is with the Clyde Iron Works, Duluth. His address is 1722 Jefferson street, Duluth, Minn.

K. W. Keiser is back at the university taking graduate work.

G. M. Larson is with the Stockland Road Machinery Company, Minneapolis.

We have no information about **O. G. Parkin.**

Delton Waby and **Harold Messer** are just finishing a power plant training course which they are taking at the Central Stations Institute of Chicago, Ill. Mr. Messer was married soon after graduation. Waby has a position with the Commonwealth Edison Company, of Chicago.

Lee L. Amidon is an instructor of thermodynamics and heat engineering at the University of West Virginia. He was very active while at Minnesota, having belonged to Iron Wedge, Tau Beta Pi, Pi Tau Sigma and other organizations.

E. Lindelien, M. E. '23, is pursuing the student course offered by the Western Electric Co., of Chicago. His address is 1012 Arthington St., Chicago.

The Great Northern Railroad Company's valuation division has seven '23 engineering graduates on its pay-roll. Two of these men, **Graydon Bachman** and **P. G. Swanson,** are graduates of the '23 Mechanical class.

The parental industry claimed another member of the family when **Ben M. Bros,** M. E. '23, went to work for the Wm. Bros Boiler and Mfg. Co., of Minneapolis. The A. S. M. E. after its inspection trip through the Bros plant a couple of weeks ago will readily testify to the qualifications of Ben Bros and his company as royal entertainers.

Chester Marshall, M. E. '23, is assistant fuel engineer at the Riverside station of the Northern States Power Co., Minneapolis. Mr. Marshall's work consists mainly of tests in the boiler and turbine rooms.

1923 ELECTRICALS

V. M. Babcock is with the Cutler-Hammer Mfg. Co., Milwaukee.

O. T. Bouquet is in the sales department of the Northern States Power Company. He lives at 619 11th Ave. S. E.

C. M. Burrill is working for the General Electric Company at Schenectady, N. Y.

F. G. Case is in the valuation department of the Great Northern Railway Co., St. Paul. **W. I. Feeney** is also with this company.

From our last report we understand that **E. W. Clausen** is with the Commonwealth Edison Company, Chicago.

R. B. Dunnavan is another of the boys working for the St. Paul Gas Light Co.

The only word we have about **D. H. Elwood** is that he is in Decatur, Ill.

E. W. Engstrom is taking the students' training course, General Electric Co., Schenectady, N. Y.

G. W. Fairbanks is in the sales department of the Northern States Power Co., Skyberg, Minn. **A. W. Kearney** also works for the Northern States Power Co.

H. W. Fischer, G. A. Johnson, W. F. Kannenberg, and **H. L. Scott** are working for the N. W. Bell Telephone Co., of Minneapolis. **J. P. Johnson** is working in the Duluth office of this company.

E. Friedman is residing at Hibbing, Minn.

One of the men who has gone into power work is **L. A. Grettum,** who is with the Wisconsin R. R. Light & Power Co., Winona, Minn.

Robert A. Hargraves is with the Minnesota Steel Company at Duluth.

O. F. Heidelberger decided to remain over another year and is taking graduate work in the electrical engineering department.

H. H. Lambie is in Chicago with the Illinois Bell Telephone Company.

H. Lieberman works in the engineering department of the Tri-State Telephone Company, St. Paul.

The only news we have of **J. B. Lundquist** is that his mail will reach him at Hibbing, Minn.

R. T. McCullough, former assistant advertising manager of the Techno-Log, journeyed east and is working with the Long Island Light & Power Co., Bay Shore, L. I.

R. H. Meserve is in the cadet training course of the St. Paul Gas Light Co., St. Paul.

Mail will reach **G. Moreno** at P. O. Box 234, Manila, Philippine Islands.

Another man in the student training course, General Electric Co., Schenectady, N. Y., is **R. O. Nash.**

J. M. Newman is working for the Cutler-Hammer Mfg. Company, Milwaukee.

Glen Nordvall is with the N. W. Bell Telephone Co., Minneapolis.

H. A. Oline is in Duluth with the Minnesota Steel Plant.

R. F. Pulver's address is care of N. W. Paper Co., Cloquet, Minn.

Harvey C. Rath began his student training at the Ft. Wayne plant of the General Electric works.

R. M. Ryan is living at 615 12th Avenue southeast, Minneapolis.

W. W. Russell has left his home state to work for the Illinois Bell Telephone Company, Chicago.

G. J. Schottler is with the U. S. Patent Office, Washington, D. C.

C. C. Schweiso, who deserted the bachelor brotherhood last summer, is with the Northern States Power Company.

E. C. Sickle is taking the students' training course in the St. Paul Gas Light Co.

The whereabouts of **C. S. Stephens** are unknown.

W. Wellisch's home address is 887 Marshall Ave., St. Paul. He is with the South Park Foundry and Machinery Co., of St. Paul.

G. W. Swift is in the testing department of the St. Paul engineer's office.

R. N. Williams and **F. W. Willson** are taking the students' training course with the General Electric Co., Schenectady, N. Y.

D. C. Wills is in Chicago with the Western Electric Co.

Mail will reach **C. R. Zimmerschied** at 3007 Grand avenue south, Minneapolis, Minn.

Donal E. Thorn is working for the Western Union Telegraph Company in Indianapolis, Ind. His home is in Cresco, Iowa.

LETTERS WE ENJOY RECEIVING

As the head of this letter will show, I am no longer in the U. of M., but in the far west in the Department of Architecture of the State College of Washington. We have charge of all buildings built on the campus, and later will begin on a greater campus plan. The work is very interesting and is punctuated at a few intervals with a little teaching along architectural lines.

In view of the above mentioned change, will you kindly change my mailing address to Pullman? The town is not large so that will be sufficient. Also please send me the January issue, which has not reached me. I certainly do not want to miss any of them.

Here's wishing the Log the best year of its history.

Very truly yours,
OGDEN F. BEEMAN,
Ex. '24.

ELECTRICALS

The world listens in on some of **Hank Forbes**, E. E. '22, ether disturbing stunts via WLAG for he is now research engineer for Cutting and Washington here in Minneapolis. As far as we know, he is playing with radio frequency now. Look around, you'll see him on the campus quite often.

"Lud" Larson, E. E. '21, is seen around the E. E. building quite often. He spent his Christmas vacation in Minneapolis with ——; you know we expect to congratulate Lud in a short time. It seems that the present Juniors treated Lud rather nice in laboratory last year, he being in charge; so now we find him instructing in the E. E. department of the University of Wisconsin.

I. S. Elestad, E. E. '21, is still in the vicinity of the campus. He is research engineer for the Minneapolis office of the Northwestern Bell Telephone Company. At the present time he is most concerned with interference from power lines.

C. S. Demerst, E. E. '11, had the leading article in the Journal of the A. I. E. E. for December; and a few months before that R. Benham, E. E. '13, had an article on "High Tension Transmission in California." This is great news for us to see the technical work of some of the alumni so well thought of.

Don Wallace, a graduate from the Academic College, has put the training received in our radio department to use to communicate with the MacMillan Expedition at the North Pole.

Two Minnesota graduates are working as engineers on the new electrical building. **George Miller**, E. E. '20, of Commonwealth Electric Co., is in charge of the electrical installation; and **A. D. Elliot**, E. E. '15, as an E. E. of the C. O. Pillsbury Company, laid out the electrical work in the building.

We are glad to hear that **H. S. Langland**, E. E. '19, is trying to cut down our gas bill. He is in charge of the valuation of the Minneapolis Gas Light Company. He is working for the Delos Wilcox Company.

We are sorry to hear that **Mr. Wilcox**, a graduate when the University was very young, is so ill that it is necessary for him to leave his work for a month. He is in charge of the transmission of the St. Paul Gas Light Company.

Irving E. Aske, E. E. '20, is working for the Kase Electric Company. He is living at 3161 Hiawatha Ave., Minneapolis.

Several of the electrical alumni have been breaking into print lately. The Electrical World of Feb. 2 published an article by **Austin Burt**, Ex. '94, explaining a rough-and-ready rule for calculating distribution lines. Mr. Burt is manager of Citizens Gas & Electric Co., Waterloo, Ia.

The November number of Journal of American Institute of Electrical Engineers contained a paper by **Charles S. Demarest**, E. E. '11, on Telephone Equipment for Long Cable Circuits, which had been read at the annual convention of the A. I. E. E. Mr. Demarest is an engineer with the American Telephone and Telegraph Company with headquarters in New York City.

The December number of the Journal of American Institute of Electrical Engineers contained a paper by **C. F. Benham**, E. E. '13, read before the Pacific Coast Convention of A. I. E. E. on Test Results on the Performance of Suspension Insulators in Service, showing the relative life of insulators on mountain, valley and coast lines. Mr. Benham is electrical engineer with the Great Western Power Co., with headquarters in San Francisco.

The leading article in the Electrical World of Jan. 19 was by **R. J. Andrus**, E. E. '07, discussing the financial and other considerations that determined the choice between enlarging a power house or building a transmission line to a water power plant 52 miles away operated by the same company. Mr. Andrus is chief engineer for the Twin State Gas & Electric Co., with headquarters at Boston, Mass.

Prof. W. T. Ryan, E. E. '05, was elected vice president of the Minnesota Federation Architectural and Engineering Society at the annual convention held in Duluth, February 1st and 2d.

G. W. Miller, E. E. '20, is supervising engineer for the Commonwealth Electric Company in charge of installing all wiring in the new electrical building.

George W. Bleecker is with the Sterling Electric Company, Minneapolis.

Frank A. Anderson is with his father, an implement manufacturer in St. Paul.

L. E. Moline is with the Commonwealth Electric Company, St. Paul, in the manufacturing department.

C. J. Snow is superintendent of shops for the Commonwealth Electric Company, St. Paul.

The marriage of **Percival E. Loye**, E. E. '21, and Winifred Sanders (Ex. '24), took place Saturday, October 6, at Palo Alto, Cal. Mr. Loye has been taking a post graduate course at Leland Stanford university. Miss Sanders is a member of Kappa Kappa Gamma.

Minnesota engineers will be interested to know that **David Grimes**, E. E. '19, talked on radio development in 1923 and prediction for 1924, Monday evening, February 11, at the meeting of the Western Society for Engineers, 1735 Monadnock Block, Chicago. **E. J. Teberg**, E. E. '16, 17, now with the Public Service Company of Northern Illinois, was instrumental in getting Mr. Grimes to address this particular meeting. **Benjamin Wilk**, E. '13, 14, secretary of the Chicago Alumni unit, as chairman of the program committee of the Western Society of Engineers, took an active part in arranging the meeting.

CIVILS

John Morrison, C. E. '22, is construction engineer for the Northern States Power Co. for the new work being done at the Riverside Station.

Lester W. Newbery, C. E. '22, has resigned his position with the War department and has accepted a position with the Manitowoc Portland Cement Company, Manitowoc, Wis. Howard B. Palmer, a classmate, is still with the U. S. Engineering department at Appleton, Wis., and is in charge of construction work on Fox river.

Ralph Johnson, C. E. '16, '17, died of pneumonia at Detroit, Mich., Sunday, February 17. Mr. Johnson was 31 years old. He was a member of Phi Gamma Delta and Theta Tau fraternities. Surviving are his parents, Mr. and Mrs. J. G. Johnson, 1457 Capitol avenue, St. Paul; a brother, Kenneth Johnson, and an infant son. His wife died in 1922. Funeral services were held Wednesday at the Hamline Methodist Episcopal church, and burial made in Rose Lawn cemetery.

(Continued on page 31)

EDITORIALS

THE PERSONAL FACTOR

Every year new students enter the doors of Minnesota and old ones go out to try their luck. The material that enters may be likened to the modeler's clay, it is soft and pliable ready to be molded into any shape that the artist may fancy. He may either make a masterpiece or an inanimate formless object which, when it is gone from his care, will be cast aside into some odd corner.

We are proud of our faculty because of their acknowledged ability in helping to make real men. It is trüe that very few use the same method but they are all striving to aid the student in discovering the powers of his personality. It has been observed that the brilliant student in the school and college has often failed to achieve a marked success in later life. The serious difficulty has been, not a lack of technical skill, nor a dearth of culture, but inability to work with others. Temperament, poise, fairness and adaptability are the values most often neglected in our college courses and yet they seem to be the most valued assets of the successful engineer.

We have been in some classes where the instructor knew his work but did not try to make it interesting or even indicate to the students that he was interested in their viewpoint. Sometimes we have had these men spend periods at a time on a subject that had absolutely no bearing on the course being taught. And in some of our electives we have had instructors who looked at their class only during roll-call and for the remainder of the time sat behind their desk and talked aimlessly out of the window. Some people seem to be under the impression that the student does not notice or care but such is not the case.

To know his subject thoroughly is not enough. The personality in the teacher is more desirable than the fact that he has a Ph. D. or an LL. D. and it is even more desirable than elaborate equipment.

BUCKING UP THE FROSH

The Senior Advisory System has been put into operation. Sponsored by Willson, adopted by the Senior class, threshed out by a committee, it received its baptism of fire at the Engineers' smoker, when, according to plan, Freshman and Senior met and talked things over.

It is far too early to say whether the plan will be a success, but we believe it is worthy of a serious trial. No harm can come of an honest attempt to smooth out some of the numerous difficulties that beset the path of the first year man. No harm and presumably much good to all concerned.

In an institution as large as this Engineering College, individual injustices are bound to occur, even in spite of the best intentions of a capable faculty, and the Senior may be able to bring such cases to the attention of those in authority more effectively than the injured Freshman himself could do. In this field, and in giving the Freshman the benefit of his longer attendance here, the Senior advisor will find his province of usefulness.

A. R. M.

SIX FELLOWSHIPS OFFERED

Five thousand dollars is available for award annually by the Charles A. Coffin Foundation, established by the General Electric Company, for fellowships in electricity, physics and physical chemistry, to graduates of the universities, colleges and technical schools of the United States who have shown, by the character of their work, that they could, with advantage, undertake or continue research work in educational institutions either in this country or abroad.

Six such fellowships were awarded last year, and opportunity is now open to make application for those to be given this year. The fellowships carry a minimum allowance of five hundred dollars per year, which sum may be increased to meet the special needs of applicants to whom they are granted. The Foundation committee in charge of the matter desires to award these fellowships to men who, without financial assistance, would be unable to devote themselves to research work. Applications will be welcomed from Seniors as well as graduates of colleges, universities and technical schools, but any award to a Senior will be conditioned upon his graduation.

Applications must be filed with the committee by April 15, 1924, and should be addressed to W. W. Trench, Secretary, Charles A. Coffin Foundation, Schenectady, New York, from whom the necessary blanks may be obtained on request. Candidates who have been graduated for more than one year may mail their applications direct to the Secretary of the Foundation, at the same address.

The committee in charge of the matter consists of Dr. John C. Merriam, representing the National Academy of Sciences; Harris J. Ryan, representing the American Institute of Electrical Engineers; and Dr. Charles F. Scott, representing the Society for the Promotion of Engineering Education.

In announcing the All-Engineers' dance, Mr. Greene promised that the entertainment committee would put on "something you've never seen at the Minnesota Union before."

Everybody thought he meant a square meal.

But it turned out to be a good looking co-ed.

MAYBE THEY DO

"Do Englishmen understand American slang?"

"Some of them do. Why?"

"My daughter is to be married in London, and the earl has cabled me to 'come across'."

COLLEGE NEWS

ARCHITECTS

FEBRUARY DESIGN AWARDS

PARIS PRIZE—FIRST PRELIMINARY
(New York Judgment)

An Entrance to a Thoroughfare

First Mention, Placed Second:
Glanville Smith
Second Mention:
E. W. Molander

SENIOR LONG (B. A. I. D.)

A Publishing House

Mentions:
Mark Nelson
E. F. C. Backstrom
E. W. Krafft
Wallace Bonsall

INTERIOR DECORATION 2ND

A Study in Wrought Iron

Mentions:
Alberta Eberhart
Gladys Hernlund

INTERIOR DECORATION 3RD

A Private Swimming Pool

Mention, Commended, Placed First:
Arthur Ruddy
Mentions:
Alberta Eberhart
Gladys Hernlund
Helen MacGregor

SOPHOMORE LONG

A Monumental Portico

Mention (commended for presentation):
D. Doon
Mentions:
R. L. Cowen
W. H. Edwards
Claude Flegal
Frank Lindgren
Dorothy Mann
Verna Smith
A. A. Melius

SOPHOMORE SHORT

A Public Square

Mentions:
Mary Slocumb
Helen Parker
Dean Rankin
F. J. Brimeyer
R. L. Cowen
Gerald Kronick
Dorothy Mann
A. A. Melius
Neal Nelson

SOPHOMORE ESQUISSE-ESQUISSE

A Monument in a Public Square

Mention:
D. Doon

FRESHMAN DESIGN

A Garden Entrance

High Awards:
Gage M. Taylor
Herbert Jennings
Sidney L. Stolte
L. W. Santo
Roy Thorshov

A Portfolio Cover

High Awards:
John M. Larson
V. H. Broderick
John M. Ramey
Stanley Cederstrand

CIVILS

The A. S. C. E. banquet took place just too late to be noted in our last issue and might now be regarded as having passed into history. But certain aspects of the affair were so unusual as to justify even belated notice, so we submit the following account without further apology.

To begin at the beginning, the meal which was served was rather the usual Minnesota Union affair, the kind that makes noon hour classes popular. Music was furnished by our well known and justly famous Cass Lake orchestra, the veterans of the summer camp.

The unusual feature of the evening was the oratory. The C. E. teaching staff was there, and each faculty man was called on for a short talk. In calling on the next speaker, the toastmaster pointed him out, made a few disparaging remarks about him, followed by a story reflecting on his, the next speaker's, intellect, rectitude and antecedents. Having thus heaped contumely upon his more or less devoted head, he told him to go ahead and talk. Some four or five of our revered mentors were thus butchered to make a Roman holiday.

The result was a series of talks which took on the character of clever retorts and showed us an almost unsuspected side of our august preceptors —facility at repartee. The fireworks were almost dazzling. Referring again to the Roman holiday simile, it may be said that the Romans enjoyed it and the victims aren't supposed to enjoy the festivities anyway.

The principal speaker of the evening was Mr. Fletcher Rockwood, a graduate Mechanical Engineer of this College, now a valuation attorney for the Great Northern Railway. Mr. Rockwood discussed the differences between the Great Northern and the Interstate Commerce Commission in regard to the problem of valuation so moderately and so judicially as to almost seem the disinterested referee rather than the advocate. Listening to him, one could hardly realize that there was some

$300,000,000 between his figures and those of the Commission. He made the point that "cost of reproduction new" assumes the railroad to be reproduced nonexistent, and that the value of land in a given territory cannot be assumed to be the price that a railroad would have to pay for its right-of-way if it were to build through that territory. Mr. Rockwood has a clear, persuasive line of reasoning that makes its point without recourse to overstatement or appeal to prejudice. His address was one of the best summaries we have heard of a much debated subject.

THE SENIOR CIVIL PARTY

About the time that this issue of the Techno-Log is in the hands of the public, half of our Seniors will receive their diplomas. Their sojourn at this so-called institution of higher learning will be at an end. Leaving the cloistered seclusion of academic life, they will go forth to do battle with a world which, according to report, is notably cold and cruel toward young engineers. Our contacts with these men, which have been casual and frequent, will in the future be accidental and rare.

With some such maudlin thoughts as these in mind, the class met and after due consideration decided to have a final get-together. Arrangements were accordingly made and the date set at February 28th.

The festivities started at the Hennepin and wound up at Roos's dining hall, where eats and short talks were in order. Reminiscences of camp life, and an ensemble rendition of "Columbo," the class song, marked the evening's entertainment. Kaufman's "The Hebraic View of Life" and Herberg's demonstration of "Why Engineers Should Take Public Speaking" were especially well received. So far as is known, everyone present mildly enjoyed the evening.

CHEMISTS

ENTERTAINMENT PAR EXCELLENCE

"Ernie" Jewett and accomplices, chief guides of the destinies of the Student Chemical Society, engineered a "mixer" in the School on February 11th that outdid anything of the kind previously carried out. 'Twas a "mixer" in the true sense of the word. Agitation of a non-political type was carried out to perfection, and an absolutely homogeneous mixture resulted. The introduction stunt was a typical chemical reaction of the non-reversible type—it went to completion; and as a result, each molecule present came in contact with and was affected by every other molecule in the mixture. The crowd might well have been called a solid solution.

The School of Chemistry is a technical school—at least so they say. We are supposedly "woman haters" like the engineers. This little mixer was therefore somewhat out of line with the usual line of things over our way. At least 20 of the fair sex were among those present, and none appeared lonesome. "Ernie" engineered their attendance and those present seemed to display previous experience in doing the rest.

Entertainment took various paths. Some tripped the light fantastic to Norm Bekkedahl's musical maneuvers on the piano. Some tried to distinguish deuces from aces in various card games. And our distinguished young lady of the freshman class taught all comers the secrets of chess. To top off the evening, the freshmen humiliated their wiser and older brothers in a spelldown on chemical formulae. 'Twas remarkable how they—the freshmen—could answer Miss Cohen's difficult questions, whereas the Juniors and Seniors slipped up on the easy queries she put to them.

Eleven o'clock had been set as bedtime. Consequently we indulged in ice cream and cookies at 11:10 and departed on time at 11:30. The party was a success—you can't deny it.

Let's have some more agitations.

ON TO CHI!

Each year about this time the gray-haired, all-wise and modest Seniors begin saving their pennies. The reason, did you ask? Well, the annual trip to the Windy City and vicinity takes place during Easter vacation, and of course pennies—maybe even dimes—must be saved in order that the sights in and about Chicago may be seen properly.

This year we embark on March 20th. Present plans are to go to Milwaukee first, remaining there until Sunday. Then camp will be transferred to Chicago. Here we shall stay until the following Saturday, when we shall return to Minneapolis if funds are still available or if brakemen are still kind-hearted. Plans are to visit several of the smaller industrial towns around Chicago also. Whiting and Evanston, Indiana; LaSalle and Joliet, Illinois, and other industrial centers are on the list.

The plants to be visited represent almost every branch of the chemical industry. Leather tanneries, sulphuric acid plants, cement plants, coal tar refineries and many other industrial plants will be inspected and later reported on. From seven in the morning until five or six at night, our feet will tread the path of inspection.

Of just as much interest to those who are going on the trip is the question of what to do from five or six in the evening until seven in the morning. Sleep may be indulged in by some. Dr. Mann will probably play billiards. However, most of us are bemoaning the fact that the Follies are in New York. We shall probably have to content ourselves with what Chi has to offer in the way of less advertised, but perhaps just as good, musical comedy, etc.

THE LECTURES CONTINUE

Each more successful that its predecessors! This seems to be the slogan and the accomplishment of the lectures being given by Phi Lambda Upsilon, Iota Sigma Pi and Alpha Chi Sigma. The attendance at the lectures given so far has been excellent, and the lectures have been of the same quality as the audiences.

On February 13th, Dr. Ruth O'Brien of Ames, addressed a large audience on the "Chemistry of Textiles" and she proved beyond the shadow of a doubt that her far-famed knowledge of the subject is not exaggerated. The lecture was interesting to all, even those who know very little chemistry. Further, it was most instructive to those who are making chemistry a profession. Nothing more can be expected of any lecture.

Dr. J. J. Willaman will speak on February 20th about "Chlorophyll, the Chemist and the World's Energy." The subject certainly is attractive, and undoubtedly this will be an excellent lecture.

On April 8th, Dr. F. H. MacDougall of the Department of Physical Chemistry, will speak on

"Some Modern Theories of the Structure of the Atom." Dr. MacDougall is an authority on this subject; and since the structure of the atom is one of the most absorbing of modern scientific problems, we all expect a wonderful lecture.

These lectures are free. They are given in the Auditorium of the Chemistry Building at 8 P. M. Everyone interested is invited and urged to attend.

ELECTRICALS

Where to Now?

The Seniors are beginning to realize that their college careers are approaching the time when "Finis" will be the only term applicable. As a result the increased acuteness of their hearing whenever jobs are mentioned is very noticeable. This is all a result of a visit made the department last month by Mr. E. B. Roberts of the Educational Department of the Westinghouse Company. Mr. Roberts was here for the annual interview with the Seniors who will graduate—or hope to graduate—in June.

We were told that application blanks would be given only to those men for whom there was a special chance with Westinghouse. So naturally upon being handed an application blank at the close of our interview we were highly elated until—we discovered that everyone received a blank!

In his talk to the class and in the interviews Mr. Roberts gave the fellows a very clear conception of the life, work and opportunities in the training course of his company. He emphasized the fact that the Westinghouse course is not a test course but is designed to train men purely for the Westinghouse organization. They are just developing a large department for carrier current telephony over power lines and are greatly in need of men with some radio training for this work.

An Interesting Experiment

One of the D. C. laboratory sections received somewhat of a scare recently when a shunt (?) motor decided to see the world for itself and ran away. Being belted to a generator it didn't blow up but did greatly increase the generator output. The only place for this flow of power to go was through a lamp-bank and through the lamp-bank it came. About a dozen lamps exploded and scattered glass all over one corner of the lab.

As usually happens about this time of year the Juniors are being initiated into the realm of mechanisms. From the remarks issuing forth as they struggle in the mazes of hypocycloids and straight line mechanisms one gathers that the electricals of 1925 are perfectly willing to confine their future efforts to the domain of electrons and ohms and leave the epicyclic gear trains to other poor benighted souls.

The Engineer as a Prophet

February 13th Mr. H. C. Evarts, functional plan manager of the Northwestern Bell, addressed the student branch of the A. I. E. E. on "The Engineer as a Prophet." His talk was on the methods used by the telephone companies to pre-determine the growth of a city or district and its probable effect on demand for telephone service from three months to ten or more years hence. He illustrated the extreme value of the various figures in the U. S. Census reports in this work and explained the painstaking care with which the companies delve into the problem.

At the same meeting N. W. Kingsley, E. E. '20, who is secretary of the Minnesota section of the A. I. E. E., spoke briefly on the practical value of applying for an associate membership when our allowable term of student membership in the A. I. E. E. expires.

As the bells toll dolefully throughout the length and breadth of our beautiful land it is with sad and aching heart that we chronicle the news of the deaths of three more aspiring young engineers. L. E. Peterson, E. F. Stinert and Max Levy, formerly of the class of '25, are the three casualties who have deserted engineering to become embryo physicists by registering for Prof. Zeleny's advanced electrical measurements course.

H. W. Bergman, ex-'25, recently underwent an operation at St. Luke's Hospital in Chicago. He is recovering rapidly. Bergman has been working for the Western Electric Co. at Cicero, Ill., this year.

Two 2 H. P. D. C. motors especially designed to run tests on separation of losses in large machines have been added to the laboratory equipment. Besides those, we recently received eight hundred dollars' worth of new instruments consisting mainly of portable Weston wattmeters in those neat little black cases. Though they belong to the electrical department the Mechanicals have already sent two back to the factory for repairs.

MECHANICALS

FLODIN ILL WITH PNEUMONIA

For the past few weeks Mr. Flodin has been confined to his bed with a severe case of pneumonia. He is now much better and is well on the road to recovery. Prof. Shipley was also confined to his bed for a couple of weeks with the flu. Apparently he didn't like being a "gentleman of leisure," leastwise he is now on the job again.

CELOTEX

A set of experiments are being conducted in the Experimental building to test the comparative strength of Celotex and wood sheathing. Celotex is an insulating board and is made from sugar beet pulp. These tests are of interest since Celotex may develop into a substitute for lumber. It is a good insulating material but its use is generally prohibited by building ordinances.

Wall sections 8'x12' are being built up and are to be tested to destruction. Three sections made of Celotex will be tested dry and three will be tested after being soaked in water for 24 hours. Three of the wood sections will be made of 1"x8" fir sheathing running horizontally and three will be made with the sheathing running at an angle of 45°. Since the number of nails used in the wood sections will vary its strength, the same number will be used in all sections. In testing these wall sections, they will be bolted to an upright girder and then the load will be applied by placing a building jack under the outer corner. A scales under the jack will serve to measure the load.

A NEW COURSE FOR MECHANICALS

The Metallography course 165s which will be offered in the Spring Quarter has been designed with the viewpoint of making it available and desirable for Senior Mechanicals. The course is designated as Technical Metallography and will pay special attention to metallography as applied to the Automotive Industry. It will constitute a study of the specification, heat treatment, fabrication, and research as applied to that field. The Automotive Industry is chosen because of its general interest and also because the greatest developments have been made in this field.

This course will follow the winter quarter course in which a study of alloy steels is made. The class will meet three times a week and three credits will be given for the course. If the student desires, a laboratory course can be taken for which credit will be arranged. Since iron and steel play such an important part in modern industry, it is desirable that every engineer knows something about its specification, heat treatment, and use.

MINERS

MINERS EXERCISE RECALL

A short notice appeared on the bulletin board of the School of Mines Society to the effect that the persons whose names appeared below wished the election of one "Stub" Case for the position of official candy carrier. It will be remembered that Elmer Jones was the former carrier. It is rumored that Mr. Jones signed the petition for Mr. Case's election. The notice read as follows:

To Whom It May Concern:

Be it hereby resolved that we, the undersigned members of the Senior class, do herein legally constitute "Stubb" Case as our representative to go after candy and that hereafter he is our true and lawful messenger.

Ten names shall constitute an election.

Sixteen names appeared. Mr. Jones, commenting on the action taken by the class, was understood to remark, "I agree with George Washington who once remarked, 'Vindicate our rights with firmness and cultivate peace with sincerity.'"

A REMARKABLE ELECTION

At a recent meeting of the Freshman class, Lewis C. Tiffany was elected Secretary and Treasurer to succeed Boyd Nelson, who has left the school. Mr. Tiffany defeated Russell Pool by three votes in a very close race. The election was marked by the lack of campaigning on the part of both candidates.

FACULTY ARE REGISTERED ENGINEERS AND ARCHITECTS

The third annual report of the State Board of Registration for Architects, Engineers, and Land Surveyors of Minnesota for the year ending December 31, 1923, shows the following members of the faculty of the College of Engineering and Architecture as registered professional engineers: Frederic Bass, A. S. Cutler, J. O. Cederberg, Jr., P. C. Gauger, R. R. Herrmann, E. W. Kibbey, O. M. Leland, F. B. Rowley and W. T. Ryan. R. C. Jones and R. Robertson are included as registered architects.

SUPREME COURT CLEARS ENGINEERS

(Continued from page 8)

The public should know that an unprejudiced judge has ruled that the charges so freely made against the engineering control of our war construction were for the most part reckless and unsustained and that the specific accusations of misconduct were untrue.

THE TRUE STORY OF ST. PATRICK

By Archie McCrady, C. E. '24

THE story of Patricius, patron saint of Ireland, is so well known as to hardly need repeating, yet so full of human interest that engineers especially take an ever-increasing interest in it. As the day nears that we have dedicated to this first and most illustrious of engineers, it will perhaps not be amiss if we refresh our memories by a repetition of the life story of our illustrious patron.

History and tradition are so intimately interwoven in the story as to become inseparable, yet in both fact and fable the outlines of a noble character are so clearly limned that we think of St. Patrick as of one who lived but yesterday. The vigor of his personality is undimmed by the centuries that have elapsed since his deeds of kindness and valor won him a place in the hearts of the Irish people.

However disillusioning the fact may be to his followers, it is clear from the record that Patrick was not an Irishman. He was a Briton, born about 389 A. D. in a small town in what is now England. He was a Roman citizen and bore the Roman name of Patricius Magonus Sucatus.

But the Roman Empire, of which Britain was a province, was on the verge of downfall, and Britain, unprotected by the Roman legion which had been withdrawn to the defense of Rome, was at the mercy of bands of Irish freebooters who periodically raided its shores. One such band seized Patricius, then a lad of sixteen, and sold him into slavery in Ireland, from which he escaped only after a six-year period of bondage.

But He Came Back

It was fourteen years later that he again visited Ireland, not as a slave but as an ordained bishop of the church. Tradition says that when he returned he found the country face to face with a famine. Cutworms in unprecedented numbers were destroying the potatoes, the staple crop. It was one of those crises that call for a strong leader, and Patrick had arrived at the crucial moment. Calling the people together, he made plans for the "worm drive" that made him famous as an engineer. He saw immediately that the way to destroy the cutworm was to foster its enemies. He imported the toad, which warred so relentlessly upon the cutworm that in a few months the former plague was completely eradicated. The only drawback to the complete success of his plan was the fact that the toads, with an abundance of food, had so multiplied as to be themselves a plague, and to the solution of this new problem he began to devote the full power of his intellect.

He found that the natural enemy of the toad was the snake. Snakes, hoop snakes, garter snakes, pythons and adders were brought into the country wholesale and turned loose. Results again justified Patrick's tactics, for within a month there was not a toad in all Ireland. Yet again as before the agency of extermination had itself become a plague, and the country was overrun by snakes. Snakebite became so common that it was considered only prudent for each man to carry a flask of the traditional remedy at all times, a custom the Irish have preserved to this day.

In searching for a defense against the snake, Patrick was somewhat at a loss until a sea captain, on

(Continued on page 30)

TECHNICALITIES

AT THE AUTO SHOW

Visitor: "What is the life of one of these Mack buses?"

Mack Dealer: "I don't know, we've only been building them since 1900."

A Case in the Short Circuit Court

A chap was arrested for assault and battery and brought before the judge.

Judge (to prisoner)—"What is your name, your occupation, and what are you charged with?"

Prisoner—"My name is Sparks, I am an electrician, and I am charged with battery."

Judge—"Officer, put this guy in a dry cell."—The Inland Merchant.

It was a soft, balmy spring night. The moon was at its zenith, casting its mellow radiance on the greensward from a cloudless sky when Jack passionately declared his love.

"My darling," he cried in tones of vibrant emotion, "I will lay my fortune at your feet."

"Oh, but your fortune is not very large," cooed the object of his affection.

"No," he replied affectionately, "but it will look large beside your tiny feet."

He won her.

"When ice cream grows on macaroni trees,
When Sahara's sands grow muddy,
When cats and dogs wear B. V. D.'s,
That's the time I like to study."

AN OLD MAID'S PRAYER

Now I lay me on the springs,
I pray the Lord for wedding rings,
And all the mighty he-male things,
Oh, give me many "men-y" things.
A—Man.

"What were your father's last words."

"Father had no last words. Mother was with him to the end."

Three great handicaps in the development of man are: Water on the knee, liquor on the hip and wimmin on the brain.—Auburn Plainsman.

Drayman: "How about some nice fresh eggs today?"

Chef at Dorm: "I can't use any eggs, but I'm short on chops. How much would you take for your mule?"

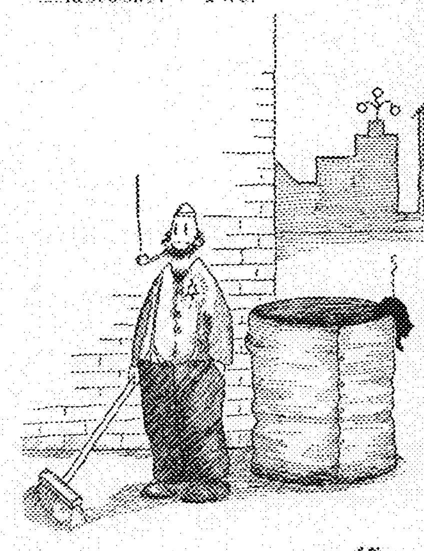
In the parlor, O my darlin',
When the lights are dim and low,
That your face is thickly powdered,
How am I, sweetheart, to know?

Every week I have to carry
Every coat that I possess
To the cleaner's. Won't you, darlin',
Love me more, and powder less?
—Exchange.

IN ELECTRIC POWER

Martin: "If you have three transformers connected YY to a three phase line and one of them blows out what will you have?"

Estabrooks: "Two."



IT SOMETIMES HAPPENS

Students who do excellent work in school are not always successful in later life, as the case of young Sidis and others demonstrates. The above sketch is one man's idea as to where some of our Tau Betes will be ten or fifteen years from now. Only his key and a look of keen intelligence remain to distinguish him from any other engineer.

VOICE OF INNOCENCE

William J. Burns said in an interview in Washington:

"You musn't believe the tall stories that murderers' lawyers tell you in murder trials about miscarriages of justice that string up innocent men. Innocent men, even in the most suspicious circumstances, have no difficulty in proving their innocence.

"'George,' a young wife said in a hard, tense voice, 'what is the meaning of that blond hair on your lapel?'

"'This is my last winter's suit, love,' George answered quickly. 'You remember you were a blond last winter.'"—From the Philadelphia Ledger.

SLIM CHANCE FOR HIM

A tailor who had been wrongfully accused of murder, and who had an excellent defense, seemed very dejected when brought up for trial.

"What's the trouble?" whispered the counsel, observing his client's distress as he surveyed the jurymen.

"It looks very bad for me," said the defendant, "unless some steps are taken to dismiss that jury and get in a new lot. There isn't a man among them but owes me money for clothes."
—London Tid-Bits.

AT THE A. C. E. SMOKER

J. Anderson: "I didn't think she was so very good."

Grobel: "Maybe she isn't the type of girl that appeals to you."

Andy: "Oh, no! She's a 'good' girl."

"Why do you object to my marrying your daughter?"

"Because you can't support her in the style to which she has been accustomed all her life."

"How do you know I can't? I can start her on bread and milk, same as you did."

L'HOMME GALANT

A Frenchman was courting an English girl. Her mother said, mischievously:

"Now, monsieur, if my daughter and I were both drowning, which would you save first?"

With great presence of mind he replied: "I would save madame and I would perish with mademoiselle!"—London News.

FROM THE BOTTOM UP

A young man just back from college was dispensing his newly acquired wisdom to a crowd of his townsmen, most of whom were older than himself.

"We all have to begin at the bottom and go up," he observed sagely.

"Yes," agreed Bob Markham, a droll, illiterate fellow, standing at the outer edge of the crowd. "We begin at the bottom of everything 'cept one."

"What's that, Bob?" demanded the collegian.

"Diggin' a well." — Everybody's Magazine.

"Papa, what are cosmetics?"

"Cosmetics, my son, are peach preserves."

Teacher (giving first assignment): "Take the first *forty* pages for tomorrow's lesson."

Freshman: "What book do we use next time?"

The popularity of the modern girl is measured by the number of Fords parked in front of her home.

"I heard your kid bawling last night."

"Yes and after four bawls he got his base—spanked."

She's stopping at the mountain house,
But great seclusion seeks,
She always dresses in the dark,
Because the mountain peaks."
—Burr.

Co-ed writes home: "Mother, my suite mate and I go to bed early since it turned cold."

Mother writes back: "Mary, you come home immediately."

Experiment No. 3
THE ELECTRICAL CAT

If friction overcomes the back e. m. f., how much hysteresis would there be in a cat's wh'sker? This question has greatly troubled all of the famous scientists of this generation, so it was with some misgiving that we set out to solve the enigma. The question that confronts us, gentle reader, is one of grave and awful moment to this country and impostority. But let us proceed to the discussion of the question.

The cat, being the originator of the cat's whisker, seemed to be the most logical subject for our needs. It was found that ordinary cats would not do; their hair would not conduct the electrical fluid properly, i. e., the coefficient of resistivity was too high. Cats with wiry hair were needed, but such cats were scarce. An old nondescript tomcat was finally chosen as the proper subject of our investigation, since it was found that said cat had the remarkable property of attracting neighboring objects to its person especially during performances on the back fence. Since a charged body attracts particles of surrounding matter; it follows that tommy was charged, and therefore capable of conducting electricity through his hair.

In order to accentuate this highly desirable property by the virtue of which Tommy had become our victim, we borrowed a spark coil from a well known make of car that was parked around the corner. The box was carefully removed, and the sealing wax knocked off with a sledge-hammer. The fine wire on the secondary was the object of our coup; it was cut into lengths of 2.71828±1 centimeters. This was the average length of the cat's hair, and was determined by the precise measurement of each individual hair by the methods of physics. The diameter of the wire was 2x3, which is approximately or very close to six mils if our calculus is correct. These pieces of conductor were grafted into the cat's skin, and formed a beautiful combination with Tommy's naturally wiry hair.

A voltmeter was connected to the cat's tail. An ammeter was connected between the fourth claw of the right hind foot to the thirteenth whisker to the wrong of the nasal protrusion. A solenoid was placed around each of the cat's whiskers—in fact, the back-fence songster was kept in an inclosure made of these same solenoids. A dozen Hibbert coils were connected in series to give the circuit the proper resistance and coefficient of self-induction. An ultra-sensitive galvanometer of the type used exclusively in our D. C. laboratory was maneuvered to detect the flow of flux from the cat's whisker. We are now ready to discuss the theory and method of our experiment.

The feline's back was stroked gently, thus producing a charge of static electricity on the cat's hair. This was immediately transformed into a current of electrons that were pushed through the wires when the charge came into contact with them. Since the ammeter showed a current, and since we cannot have current without e. m. f., it follows that the experimenter's hand produced a high tension current in its passage over Tommy's back.

Our hypothesis states that friction is to overcome the back. Obviously, overcome is here a garbled version of come over. Therefore, restating our premise, we have, "If the friction comes over the back, e. m. f. being generated, what is the hysteresis in a cat's whisker?"

Since we have already taken care of the conditioning elements in our statement, nothing remains but to investigate the hysteresis in the feline's mustache. A curve was plotted from the readings of the galvanometer. It proved to be a straight line, that is, the said cat's whiskers had no hysteresis loss. The high permeability of these whiskers may be demonstrated by the gentle humming or purring sound that is in evidence when the cat's back is stroked. This indicates a loose transformer core. The phenomenon cannot be averted since the cat is inadjustable in this connection. Since a transformer has a highly permeable core of sheet steel, the conclusion is that the cat's whiskers are highly permeable and very conducive to flux. Since they have no hysteresis loss, they are superior and should replace all iron in electrical machinery.

Cats can be bred which have not only highly permeable, non-hysterical whiskers, but which will also have insulated copper hair. Thus the lowly cat will supply all of the necessary materials in the future for the manufacture of electrical machinery.

Respectfully submitted,
R. W. KELLER.

FUNCTIONAL PLANS OF NEW UNIT

(Continued from page 7)

always ready for use for exhibit, study or testing purposes anywhere. Heavy apparatus, such as dynamo machines, are moved by the two cranes in the main laboratory and by trucks to other points. The elevator is provided with an inching device to justify floor levels so that caster-equipped racks and benches as well as trucks may be taken to different floors.

(7) The features referred to under service above are also available in class rooms. Portable lecture table-sections carrying demonstrations may, for example, be fitted out in the dynamo laboratory or in any communication laboratory and then taken to any class room or to the lecture hall for experimental demonstration.

Each class room and the lecture hall has, near the entrance, three switches for control of room lighting, special blackboard lighting and for starting and stopping the ventilating motor for the particular room.

The lecture hall has a capacity of about 200 tablet chairs set on steps of increasing height from the front row back. A set of large instruments are to be mounted just above the blackboard back of the lecture table and a miniature set of instruments mounted on the table so that the demonstrators may note the readings without turning around.

(8) Each instructor in charge of a laboratory fixes responsibility in case of damage to instruments and sends the instrument to the proper place to be repaired and damages recorded. Damaged instruments are not left in the cases. All shipping, in or out, passes through the service hall at the foot of the elevator in the basement, Fig. 3. The loading platform is shown on the first floor plan, Fig. 4, and the section sketch, Fig. 2. Very large and very heavy apparatus is received through a large door in the east end of the main laboratory, Fig. 4.

It is believed that the arrangements outlined above will provide all the necessary service for experimental purposes at the lowest possible expense of time and money and with the minimum of red tape.

Future Changes

Provision for changes within the building required by future developments of the art of using the effects of electricity and magnetism are believed to be made as shown above. For changes due to growth in size, the building may be enlarged by extending the head house on the north end to make a symmetrical "T" shaped building, as indicated in Fig. 1, an "L", "U" or a complete quadrangle, with the present building constituting the south side of the square thus formed.

The laboratory end may be extended eastward by some such extension as the present neck is on the west end.

The building is constructed so that a roof house may be added to the headhouse and to the main laboratory without any material changes in the present structure.

For the State Board of Control:

Architects—Clarence H. Johnston, 715 Capital Natl. Bk. Bldg., St. Paul, Minn.

Engineers—Chas. L. Pillsbury Co., 1200 2nd Ave. S., Minneapolis, Minn.

AS A WESTERNER SEES NEW YORK

(Continued from page 13)

is interesting to visitors and yet one cannot help but wonder what it is that causes conditions such as these. People live like cattle. The tenement houses are ancient and in poor repair. Three or four families live together in a seven-room tenement. Most everything is sold on the streets from pushcarts. Here one can buy anything from a sandwich to a suit of clothes. Children, looking as though they never had a bath, play in the narrow, filthy and congested streets. It is a sight one does not easily forget.

New York is not, however, entirely without good attributes. Because of its size, it is the home of many interesting and valuable institutions. It offers exceptional opportunities in the realm of education and amusement. One of the most widely known universities in this country, namely Columbia, is located on Manhattan Island, where graduate courses in literature, science and arts are offered. New York also is the seat of great public libraries and semi-public libraries, such as the Engineering Societies Library with its 150,000 volumes on engineering and allied subjects. If one has a craving for music there are innumerable operas, concerts and recitals. A great number of concerts and recitals are free, such as the Friday and Saturday noon concerts which are given at Aeolian Hall and other similar places. If the stage appeals to you there are innumerable places to go, from the light musical comedy such as the Ziegfeld Follies to real drama such as Shakespearean plays.

Some Real Sights to Be Seen

Another important asset to residence here is the opportunities for hearing and seeing famous lectures and exhibits. There is a never-ending array of them. Practically any internationally known lecturer, provided he comes to America, can be heard in New York City. The same thing is generally true of famous exhibits. If your inclinations are in part somewhat religious there is no shortage of churches in New York. Many of these churches are internationally famous because of the beauty of the church buildings and also because of their ministers who have charge of them. New York is not overstocked with parks and public playgorunds, when one considers the multitude of people. Nevertheless there are some real sights to be had in the Zoological and Botanical Gardens located in the Bronx Park. The Aquarium, located at Battery Park, is also well known even beyond New York for its elaborate collection of fish from all parts of the world. The American Museum of Natural History is famous because of its possession of the largest collection in the world of gems and gem material, exhibits on the evolution of the horse, and collection of meteorites.

These in general are the things which have attracted some of my attention. Naturally there are many other things, such as the steamship lines, the financial district such as Wall Street. All these things are of great interest to any wide-awake young man or woman and, considering everything in a broad sense, there really is no reason to get "bored" in New York.

I suppose we should say a few things concerning living conditions for young men such as myself. This is rather a hard thing to comment on, inasmuch as individual tastes vary widely among men.

New York is not the worst city to live in; yet, on the other hand, I know of cities which, if I could have the same professional opportunities, I would choose in preference to New York. About the only item that is greater in value than in most other cities is property. This naturally brings with it higher rents. Food and clothing are not very much more expensive than in any other large city. On the whole New York is not so very exceptional. From my viewpoint it is just an average American city with the usual quota of political and social scandals and crimes. The climate is not extreme either in temperature or in humidity. Health conditions, according to the statistics given in a late number of the "Literary Digest," are good compared to many other cities. New York has a death rate of 12 per thousand as compared with 10.8 for Minneapolis, 11.2 for Chicago, 12.5 for St. Louis or 13.2 for Philadelphia. So in closing I would say that if you men are skeptical as to living here to put your fears aside. New York is not quite as ideal as Minneapolis from a living standpoint, but consider that Minneapolis to a great extent is an exception to the rule as far as civic conditions are concerned.

HIGH SCREEN EFFICIENCY SECURED

(Continued from page 11)

the picture projected, and this limit was reached by several theaters.

There was little opposition after 1917 to the theory of Griffiths, but for some time it was not placed upon a mathematical basis. Only recently he published a set of tables giving dimensions of the optical system, not altering the original theory, however. Greene made some computations for his own use a year ago last fall, and Griffiths came out with his tables last spring. Greene checked the two sets of calculations; since they agreed, no change was made in the University optical system.

Projection at Minnesota excels because: (a) the lens system conforms exactly with the theory of Griffiths; (b) the carbons are worked to the limits of their capacities, obtaining a high density of current and a high concentration of energy in the crater of the positive carbon, without liberating sufficient energy in the carbon itself to cause it to go to pieces.

HOW TO HOLD A HUSBAND

"Clara, do you know anything about this book, 'Thirty Ways to Hold a Husband'?"

"No, but I think the stranglehold is best."

COURTEOUS BUT SPECIFIC

"You have heard what the last witness said," persisted the counsel, "and yet your evidence is to the contrary. Am I to infer that you wish to throw doubt on her veracity?"

The polite young man waved a deprecating hand. "Not at all," he replied. "I merely wish to make it clear what a liar I am if she's speaking the truth." —Tid-Bits.

A NAUGHTY LADY

Mother—Come, Bobbie, don't be a little savage; kiss the lady.

Bobbie—No, she's a naughty lady. If I kiss her she may give me a slap, just as she did to papa.

THE STORY OF NEWSPRINT PAPER

(Continued from page 10)

wise against the grindstone to obtain fiber instead of wood flour. About once or twice a day the grindstone must be dressed with a specially prepared tool to prevent its becoming glazed and to maintain the desired grinding surface. The quality of ground-wood produced depends almost entirely upon the character of the surface maintained on the grindstone. A common form of grindstone dressing consists in making tiny grooves diagonally across the grindstone surface about one-eighth of an inch apart. If the grindstone is sharpened too much, little but slivers is produced; if it is not kept sharp enough, a very fine, almost powdery, pulp is produced, at great waste of power.

A Pulp-Grinder Governor

Since so much power is required for grinding wood, there are opportunities for effecting large economies in this process. The grindstones are usually driven by water-wheels. These water-wheels must run at certain speeds in order to produce the most power from the water they are using. The problem of controlling the speed of the water-wheels driving pulpwood grinders has been an extremely difficult one. The writer was fortunate in finding a solution about four years ago in the form of a pulp-grinder governor. By means of this governor, a real conservation of water-power is effected. The water-wheels are forced to run at their most efficient speeds at all times, and in this way about 10 per cent more and better pulp is produced with the same water-power, the same machinery, the same labor; in fact, at no cost but that of the wood ground. Since these grindstones run at comparatively high speed, it is not uncommon for them to burst and to cause damage to machinery and often, also, injury to men working around them. The Meyer governor also practically eliminates these accidents.

Ground-wood pulp and sulphite pulp are mixed in the proportion of about four to one with a little alum and sometimes china clay and blue color, in the production of newsprint. After these two kinds of pulp are thoroughly mixed, they are sent to what are known as "tub beaters" and "Jordans," where the fibers are rubbed out and refined somewhat further. This latter operation, however, as a rule produces relatively minor changes in the character of the pulp. At this stage, the pulp is relatively thick; that is, about like a thick soup—although naturally quite different in character.

Making Pulp Into Paper

Before coming on the paper machine, the pulp is thinned out until there is only one-half part of woodpulp in every hundred parts of water. In this form it is fed into one end of the paper machine and it emerges at the other end as a broad band of dry paper. The dilute pulp is pumped into a pond at the wet end of the machine and flows out under a narrow, sharp-edged dam, from one to two feet high, known as the "slice," onto a fine wire screen, varying in width up to 234 inches on the widest machine in use. This wire screen has sixty meshes to the inch and is woven in the form of an endless belt from 50 to 100 feet long. It is supported by brass rolls and runs at a speed up to 1,000 feet per minute in the fastest machines. The dilute pulp flowing out upon this screen-belt from under the dam is supported at the sides of the wire and kept from running off by another endless belt, consisting of a heavy strand of rubber about two inches square, known as the "deckle strap." The water flows out through the wire screen, depositing the fine pulp fibers on the wires. Near the lower end of this screen, technically known as the "wire," there are suction boxes which draw out more of the water. At the end of its run, the wire passes under a felt-jacketed or "couch" roll which presses out still more of the water. Just beyond this first press the soft sheet of pulp is led off from the wire and the couch roll onto a belt of heavy wool felt. It now passes along, supported by this felt, between two or three more presses, where additional water is squeezed out until the sheet consists of about 25 per cent pulp and 75 per cent water. The sheet actually appears to be very much dryer than this. It still has very little strength, however, and must be very skillfully handled in transferring from the wire to the wet felts and from these, after passing through the presses, to what are known as the "dryer felts."

Immense Volume of Water Evaporated

The dry end of the paper machine consists of a large number of steam-heated rollers several feet in diameter, through which the soft sheet of paper is threaded on the dryer felts back and forth between the rolls. In this portion of the machine the remainder of the water is evaporated. Few people have any conception of the amount of water which is daily evaporated by the paper machines of a large mill. Expressed in familiar terms, it is equivalent to fifteen or twenty 35-ton carloads. The amount of water pumped and used for all purposes in one of these large mills is about equal to the amount of public water supplied by the city of Minneapolis.

After being thoroughly dried, the sheet of paper passes through a number of polished ironing rollers placed one on top of another, in what is known as the "calendar stack." Here the paper is given its finish. From the calendar stack, the band of paper is led to a reel where it is wound up as it comes from the machine. The large rolls are then placed on a rewinder where the broad band is sent through under circular knives and cut into the desired widths and wound on cores into rolls suitable for use in the printing presses of our dailies.

The tremendous amount of paper produced in a large paper mill will best be appreciated when stated in terms other than tons per day. For example, the mill at International Falls, and its companion operated by the same company, just across the river in Canada, of which the writer was for a time general superintendent, turns out paper at such a rate that three six-foot bands could travel continuously back and forth across the continent from the Twin Cities to the Pacific Coast with the three crack transcontinental trains of the Great Northern, the Northern Pacific and the Chicago, Milwaukee & St. Paul Railway. Expressed in another way, the paper produced by these mills each day would cover about 1,600 acres of land.

To provide the wood for the production of the tremendous quantities of newsprint paper consumed in the United States each year, large areas of forest must be cut over. The trees most suitable for pulp production are relatively slow-growing and our supply is fast diminishing. Inferior woods must come into use and well organized efforts must be made to grow forests on those areas unsuited to the production of agricultural crops; otherwise our pulpwood supplies will be exhausted before we are aware of it.

—Reprint from "The Bulletin" of the Minnesota Federation of Architectural and Engineering Societies.

THE TRUE STORY OF ST. PATRICK

(Continued from page 22)

his return from an African voyage, brought a cargo of gorillas to Ireland. It was discovered that the gorilla's favorite delicacy was a live snake; so all that remained to be done was to import gorillas in sufficient numbers to exterminate the snakes. Their complete eradication was effected within eighteen months.

A period of prosperity followed, the like of which the country had never seen. Crops were abundant and life was easier for the peasants. It was during these plentiful years that Patrick founded the University at Armagh and wrote his best songs.

Then a new difficulty beset the unhappy country. The gorillas, deprived of their favorite food by its extinction, were becoming restless. In well organized bands, under capable leaders, they began marauding the outlying settlements of Connaught, seizing the crops and terrifying the inhabitants. So great were their depredations and the terror which they inspired that whole counties were depopulated, until in 430 there was not a man, woman or child in all Connemara. Relentlessly the inhabitants of the northern counties were driven southward, until Dublin itself was in danger.

In this crisis, as in previous ones, the people looked confidently to their peerless leader, and again they were not disappointed. The difficulties of the situation only served to accentuate his resourcefulness, his courage, and his sterling worth. Taking full charge, Patrick sounded the tocsin and every ablebodied man seized his shillalah and placed himself at the disposal of his leader and his country.

The hastily organized patriot army promptly moved into enemy territory and encountered the enemy on the plains of Limerick. An immediate attack was ordered and wave after wave was hurled against the enemy front, only to be thrown back and give way to another attack. For three days and nights the conflict raged, but at noonday of the fourth a breach was made in the enemy ranks. Hurling his last remaining reserves into the gap, Patrick forced a retirement which soon became a rout. Seventy-two thousand one hundred forty gorillas were slain before darkness put an end to the slaughter.

That Ended the War

Organized resistance was broken by the victory of Limerick, but a sort of gorilla warfare continued for several years before the last of the beasts were killed off. A bounty was placed on their heads and it became the duty of every man to hunt and kill every gorilla he saw.

It was during this phase of the war that a peculiar situation developed. Reports of bloody duels between Irishmen became more and more frequent, and investigation showed that in every case each man had mistaken the other for one of the enemy. It is estimated that over 7,000 were killed in this way before the matter was brought to the attention of Patrick, now an august Dean of the Engineering College at Armagh.

He acted immediately. In a proclamation dated March 17, 431, he directed every Irishman to wear a sprig of shamrock or other green foliage at all times. This measure, simple as it was, put an end to the lethal encounters and possibly saved the nation from self-destruction. And long after the need for such distinctive badges had disappeared the people continued to wear them as a mark of their loyalty to the great leader who had guided his country through its most critical years.

ALUMNI

(Continued from page 17)

Carl A. Taylor, Chem. '09, '10, is employed as explosive chemist by the Pennsylvania Bureau of Mines, and lives at 4800 Forbes street, Pittsburgh. His family includes Mrs. Taylor (Margaret Smith, '13) and two children, Fred, aged 6, and Kathryn, aged 8.

E. A. Daniels, Chem. '12, Gen. '13, '17, has been made an engineer in charge of the chemical development of plastic materials for use in telephone equipment for the Western Electric Company in Chicago. **F. M. Williams**, E. E. '05, '09, has been promoted to superintendent of the equipment engineering branch of the company. This organization has charge of all engineering work in connection with the installation of switchboards in the telephone exchanges.

MECHANICALS

A. J. Nordenson, M. E. '21, is doing drafting and design work for the Strong & Scott Co., the manufacturers of flour machinery. Mr. Nordenson resides at 4244 12th Ave. S.

Frank Hughs, M. E. '03, has invented a valve which is being used in a tire tube which he and Prof. Lewis, of the chemistry department of Northwestern University, are manufacturing. It is called the "Airlox Airtight and Puncture Proof Tube" and was displayed at the last Twin City Auto Show. They also manufacture a police hand grenade which is extensively used.

A. G. Nordinson, M. E. '21, is doing drafting and design work for the Strong & Scott Co., of Minneapolis.

E. F. Jones, M. E. '17, is mechanical engineer in the city architect's office, St. Paul. He has made the mechanical layouts for many of the large new schools of St. Paul.

Floyd Olmstead, M. E. '22, after having spent a year of post graduate work at the University, is with the Mahr Manufacturing Co., of Minneapolis. Mr. Olmstead is engaged in experimental engineering work for the concern, which manufactures oil burning equipment. His residence is at 1525 E. River Road.

John Farmer, M. E. '21, has a position with the Nott Contracting Co. as estimator. He has been with the firm, which specializes in boiler and pipe insulation, for about a year. Mr. Farmer resides at 2315 4th Ave. N.

Lehan H. Hamlin, M. E. '21, completed the post graduate course in '22 and has since been in the employ of the Power Department of the Minneapolis Street Railway Co. He was in the steam station about ten weeks and has since been in the office at

11th St. His office work has consisted largely of drafting, designing, and the preparation of reports. Mr. Hamlin resides at 4422 Colfax Ave. S.

George Borrowman, Chem. '05, who is a consulting chemist with offices in Chicago, has been a central figure in a fight which was recently waged in Michigan courts over the validity of a patent for zeolitic water softening. The details of the case are given in an item from the Chemical Bulletin of January, 1924.

Another round in the zeolite fight ended November 9th at Detroit, Michigan. On that day Judge Tuttle, of the U. S. District Court for Eastern Michigan, ruled that the Gans' patent, U. S. 1,195,923, which if held valid would give the Permutit Company practical control of zeolitic water softening in this country, is void.

The decision will be of interest to the many chemists throughout the country who have followed the complex and hard-fought struggle being waged between the Permutit Company and other concerns in the zeolite field. The decision will be of special interest to many of us since it affects George Borrowman, of the local section, whose U. S. licensee the Wayne Tank & Pump Company was the defendant.

The case was of long standing. In 1918 the Borromite Company of America was Borrowman's U. S. licensee. The Massachusetts Laundry Company of Detroit, one of its customers, was sued by the Permutit Company.

Henry C. T. Eggers, E. '15, 16, is assistant professor in the engineering department at the University, having been promoted to that position last spring. Mrs. Eggers was Hazel Lauritzen ('19 Ag.).

Donald H. Buckhout, Arch. '17, is married and has added to his possessions a son, 17 months old. Don lives at River Home, Perrysburg, Ohio, and commutes to Toledo, where he is working as an architectural draftsman.

Clinton L. Brooke, M. '23, has resigned as chemist in the state experimental flour mill in Minneapolis to accept a two year contract as chemist for the second largest flour manufacturing company in Sweden. Mr. Brooke sailed from New York on January 27 for Upsala, Sweden, where the mills are located. He obtained the contract through H. W. Soderman, Jr., son of a member of the Swedish firm, who spent several months in Minneapolis while studying American flour milling methods. Mr. Brooke is a member of Sigma Rho, a school of mines fraternity, and has been with the Minnesota state mill since its organization in 1921.

Mr. F. R. McMillan, C. E. '05, formerly instructor in the structural department of the college of engineering, but now a consulting engineer in Minneapolis, has been elected as the representative of the N. W. section A. S. C. E. on the Board of the Minnesota Federation of Architecture and Engineering Societies.

Mr. Aaron Horwitz, C. E. '20, who since leaving school has been in the employ of the St. Paul Planning Board, has recently accepted a position with the newly formed Planning Board of Duluth. Mr. Horwitz will be in charge of all matters related to zoning including the drawing of the ordinances.

MICHAEL FARADAY
1791-1867

Apprentice to an English bookbinder. Attracted the attention of Sir Humphrey Davy, becoming his assistant. "The greatest experimentalist of all times," says one biographer. The electrical unit Farad was named for him.

"What's the use of it?"

Michael Faraday saw the real beginning of the age of electricity nearly a century ago when he thrust a bar magnet into a coil of wire connected with a galvanometer and made the needle swing.

Gladstone, watching Faraday at work in his laboratory, asked, "What's the use of it?" The experimenter jestingly replied, "There is every probability that you will soon be able to tax it." The world-wide use of electricity that has followed the Faraday discovery abundantly justifies the retort to Gladstone.

Faraday's theory of lines of force is constantly applied in the Research Laboratories of the General Electric Company in devising new electrical apparatus of which Faraday never dreamed. Every generator and motor is an elaboration of the simple instruments with which he first discovered and explained induction.

in 1880 the Edison Electric Illuminating Company, of New York City, installed a generator of 1200 lamps capacity, then considered a giant. By continuous experimentation and research the General Electric Company has developed generators 900 times as powerful as this wonder of forty years ago.

GENERAL ELECTRIC

MINNESOTA TECHNO-LOG

VOL. IV. NO. 6 APRIL 1924

Published Monthly During the School Year by the Students of the College of Engineering and Architecture, School of Chemistry and School of Mines of the University of Minnesota

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

Published and Copyrighted Monthly by

The Engineering Students
of the
University of Minnesota

Main Engineering Building, Minneapolis, Minn.

Subscription $1.50 per year — Twenty-five Cents the Copy

VOLUME IV — APRIL, 1924 — NUMBER 6

TABLE OF CONTENTS

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: Prof. Edwin Kurtz, Iowa State College, Ames, Iowa

The Cornell Civil Engineer
The Transit
Iowa Engineer
Colorado Engineer
Nebraska Blue Print
Penn State Engineer
Sibley Journal of Engineering
Rose Technic
Michigan Technic
Minnesota Techno-Log
Virginia Journal of Engineering
Ohio State Engineer
The Towne Scientific Journal
Wisconsin Engineer
Illinois Technograph
Tech. Engineering News
Kansas State Engineer
Princeton E. A. News Letter
Kansas Engineer

More Load

TIMKEN

Tapered ROLLER BEARINGS

Greater simplicity and reduced weight are fundamentals of mechanical refinement. The constant tendency toward simpler, lighter machinery of all kinds is accelerated by the ever-increasing use of Timken Tapered Roller Bearings.

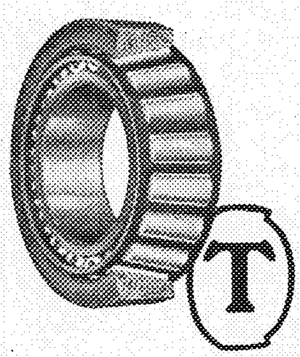
Their design is inherently adapted for Dual-Duty — the carrying of radial loads *and* thrust loads *and* resultant loads simultaneously. By taking advantage of this multiple ability of Timkens the designing engineer avoids much more complicated construction otherwise needed to do the work. With Timkens he immediately reduces the number of parts and consequently he eliminates excess weight.

And since the Timken principle also permits greatest load to be carried per unit of space required, Timken mountings are most compact, so that housings are smaller.

When any one housing or unit may be made smaller and lighter, all related parts in turn may be similarly refined. Thus Timkens, in themselves a refinement, favorably influence the entire mechanism in which they are used.

And Timken influence in bettering a machine never ceases, because when that wear which eventually *must* follow motion does come, its deteriorating effects need not be tolerated in Timken-equipped mechanisms. Timkens can be *adjusted* to function as when new.

The Timken Roller Bearing Co
CANTON, OHIO



Less Space

MINNESOTA TECHNO-LOG
University of Minnesota
VOLUME IV APRIL, 1924 NUMBER 6

SAINT PATRICK IS WITH US AGAIN

Professor Priester Originally Brought Him to Minnesota--- Has Officiated Five Times

By Albert W. Morse, E. E. '25

Chairman of Publicity, Saint Patrick's Day, 1924

PROFESSOR George C. Priester, more than any other member of the student body or faculty, is responsible for Saint Patrick's Day at Minnesota. His interest and activity fostered the idea and developed it into an established institution, and it is thoroughly proper that he should receive recognition for his work in the interest of the University and the College of Engineering and Architecture.

When a senior at the University of Iowa, Mr. Priester was a member of the committee which managed the first celebration at that institution. The parade, knighting ceremony and open house during Mecca Week at Iowa are similar to those at Minnesota; but there the engineers stage a show which corresponds to the Arabs' production.

Came to Minnesota in 1910

That fall, in 1910, Mr. Priester came to the University as an instructor, and he sold the idea to his freshmen students. Not until they were seniors was any action taken, and in the spring of 1914 they had Mr. Priester take the part of Saint Patrick in the first celebration at Minnesota.

Professor George C. Priester

The slight show of rivalry between the engineers and the miners exhibited on Saint Patrick's Day is but the phantom of bloody combats of the past. Anticipating trouble, the engineers hid the Blarney stone in 1915 in a shed back of Professor Frank B. Rowley's home, which stood on the location of the new library. The miners heard about it, and an epochal struggle ensued. One of the few guarding the stone dashed over to the main engineering building and gave the alarm, and a spectacular exodus from every available window and door followed. In his efforts to pacify the combatants, Mr. Rowley unwittingly became embroiled in the maelstrom; it is said that the engineers were reluctant to let the miners leave. The miners attempted again to get the stone away in 1916. They even rolled it down the river bluffs, but engineers recovered it from the water.

Mr. Priester has been Saint Patrick five times, in the years 1914, 1915, 1917, 1918 and 1920; in recent years, the students have followed his advice by propagating the honor among the student body and faculty. In the years 1916 and 1919, the position was held by post-seniors. John H. Kuhlman, an instructor in the electrical department, was chosen in cal department, officiated in 1923, and this year Archie Rowland McCrady, of the senior civil class, has the distinction of being the first undergraduate to be Saint Patrick.

The movement has assumed ever-enlarging proportions since the sophomore engineering class of the University of Missouri was led by the romantic influence of spring to follow the advice of one of their classmates, a Mr. Hain, who proposed on March 16, 1905, to take a holiday on the following day. The juniors and seniors followed the lead of the sophomores, and no one went to class on Saint Patrick's Day; they simply paraded about town, but next year a regular program of ceremonies was built up, including the award of certificates.

Shows Purpose of Celebration

With reference to Saint Patrick's Day at Minnesota, Mr. Priester says, "On the annual Saint Patrick's Day at the University of Minnesota, the engineering student exhibits to the public the numerous facilities with which the college has provided him in order that he may continue the transformation of the forces of nature into real, workable, labor-saving and useful devices.

"He does this in order that those who have only a very little knowledge of his profession may learn that the engineering profession is the greatest agency and instrument in advancing civilization. It is a part of the engineering student's duty now, and as an engineer after graduation to continually demonstrate to the public that it is through his instrumentality that economical and practical devices are obtainable, while without the engineer's assistance there would be waste, suffering, inconvenience and inefficiency.

"The engineering student has on this day the first opportunity to show his wares. These he should continue to show after he enters his truly professional field, with due respect for all of the moral ethics of his profession. On this day, he must do his part in co-operation with all of his co-workers. Here he learns that in order to accomplish the greatest amount of work with the least amount of exertion he must be able to unite his efforts harmoniously with his fellow-men.

"In such a large institution as the University of Minnesota, the student experiences great difficulty

THE PSYCHOLOGY OF ADVERTISING

He Who Refuses to Read the Ads. for Self-protection Really Gets Self-isolation

By S. Caryl Chapin, C. E. '24

Advertising Manager of the Minnesota Techno-Log

HOW little the average reader suspects the psychology behind the ad that first compels his attention and then finally interests him to the point where he is willing to buy! How little the average buyer realizes that he is being met by master salesmen at every turn of the head! The cynic who remarks that advertising does not affect him and that he has yet to meet the salesman that can get under his skin is still with us. Does he realize that the cry of "WUXTRA" that stops him on the street corner and causes him to part with the two cents for an evening paper is advertising? And what of the street signs that attract him to the down-town district in the evening to "see the sights," and of the window display in the haberdashery that causes him to buy that new necktie? Yet, for all that, we are continually irritated by the ignoramus who refuses to stop and read the ads in his magazines and papers. Self-protection, he calls it. Self-isolation, we call it.

The Engineer Needs the Advertiser

The Engineer boasts of being a benefactor to society. "Look," he says proudly, pointing to the telephone, the electric washer, vacuum cleaner and all the other little conveniences that makes possible the slogan, "Buy these and keep your wife for a pet," "These are the things that I have given you." Truly enough, Oh, Engineer, but what would they amount to if every housewife had hurriedly turned the pages of her magazine with the word, "self-protection"? America has been termed a high-pressure nation, and who, if not the engineer, is largely responsible for much of that pressure and power? In fact, the chief problem of the modern engineer is the problem of developing higher pressures and more power. Yet, the direct result of this high-pressure spirit has been the development of the advertising field. If the engineer must produce some new machine at every turn of the wheel, he must admit the civility of recognizing his co-partner, the advertising man. One is the result of the other, and therefore let them work together for their mutual good.

We cannot truthfully say that all the fault lies with the engineers or with the average host of readers who fail to find a significance in the panorama of scientific development that is continually being unfolded to them through the advertising pages of our publications. What about the producer who believes that advertising does not pay? Is he not more misled than the man who fails to note the advertisements that are presented to him? Should I live to rival Methuselah's record I verily believe that I should never forget that phrase, so familiar to the advertising staffs of college publications, "Sorry, but our charity work is limited and we must give preference to churches." Is it humor or ignorance or merely an attempt at intimidation? Surely most prospective advertisers must know that advertising solicitors are previously provided by a considerate mother nature with hard shells resembling those of the tortoise family, into which they can withdraw when the tirade breaks loose. For much the same reason, we must discard the theory of humor because the sickly humor of the classroom must long since have made the victim impervious to new attacks. What ho! That leaves only the serious charge of ignorance to be preferred against the offending prospect. Much the pity if he believes that he is giving his ads to a college magazine for philanthropic purposes. He is failing to discover an important source of demand. What is more reasonable to expect than that a student who is setting his mind on discovering the intricacies of design should also discover those products which are to help him at a later date to affect that design or construction? Let it not be said that the producer is merely the agent of the engineer, producing for the public what the engineer has designed. From the very nature of his training, the engineer should be a critical and important buyer. The man that is trained to carefully file for possible future use such data as may come to hand from time to time is not the man who would carelessly pass over an advertisement of a new and modern machine that might mean large savings to him at a later time.

Thus we have the situation in the field of College magazine advertising that there is not a meeting of minds—a mutual understanding between advertisers and the student readers. Students must be educated to see the benefit derived from reading the advertisements while the advertisers must be educated to see that the student field is a large, though indirect, field for advertising. Where a situation of mutual distrust now exists there must be a feeling of mutual benefit on the part of both reader and advertiser. It cannot be expected that a student body can form a large field of direct buyers. This is more particularly true, of course, where technical advertisements are used but it also applies to clothing dealers and haberdasheries. What if the men are too poor to purchase a suit quarterly? If they can be educated to take pride in good clothes and at the same time come to associate the standard names with good clothing the point is won. What matters if the buyer be a graduate or a student? He has learned to dress well through his college training and therefore the advertiser and the buyer have secured the benefit of the advertising.

Read the Ads To Be Progressive

The advertising field is here to bring the buyers into contact with the sellers. Our advertisements spread out before you only the products that are the best and the most necessary to your own welfare as an engineer. If you want to be progressive, read the ads. They give you the most for the least and by reading and assimilating the knowledge contained therein you may be able to lay the foundation for a later business success. Keep up with the ads and you will find that the world is not leaving you behind.

When a normal man sees a message written to him, something that is newsy, terse, timely and

(Continued on page 32)

COMPARATIVE STRENGTH OF WALLS

Suitability of Celotex and Wood for Sheathing Shown in Laboratory Tests

By Professor Frank B. Rowley
Director of the Experimental Laboratories, University of Minnesota

IT sometimes happens that custom and habit dictate the type of construction used in certain engineering projects to such an extent that but little thought is given to changes which might be decided improvements. Thus in the matter of placing wood sheathing on the walls of ordinary frame houses, the accepted way for years has been to place this sheathing horizontal or at right angles to the studding. In special cases such as two-story frame houses built for a brick veneer, the sheathing has been placed diagonally with the idea of increasing the strength, but with little thought as to how much the strength of the walls so constructed was increased. The constantly increasing price of lumber has also brought up the question of substitutes for the wood sheathing which would fulfill all of the requirements and would either be cheaper or would have other additional good qualities which would warrant their adoption.

Some recent tests made at the Experimental Engineering laboratories have brought out very clearly the comparative strength of walls constructed of horizontal wood sheathing and diagonal wood sheathing, as well as of walls constructed of celotex lumber, a comparatively new building material on the market and one which at first thought would seem to have but little strength as compared with wood sheathing.

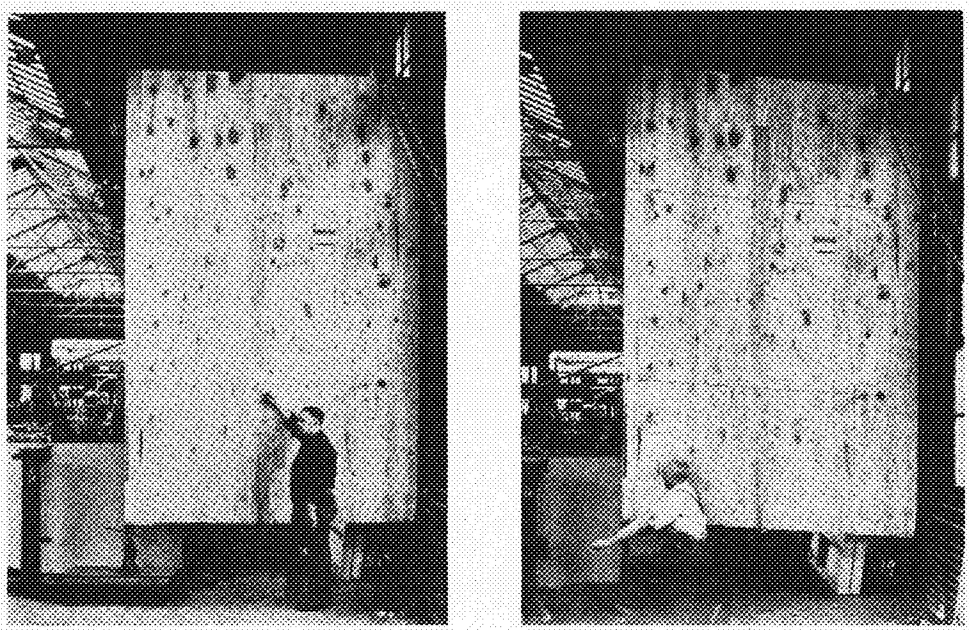


Fig. 1. Horizontal Sheathing Before and After the Test

Twelve Wall Sections Used

In making these tests, twelve wall sections, eight feet high by twelve feet long, were constructed; three were covered on one side with No. 2, eight-inch, fir, shiplap placed horizontally; three with No. 2, eight-inch, fir, shiplap placed at an angle of 45° to the studs, and six with four-feet-by-eight-feet sheets of celotex lumber placed parallel to the studs. The frames for these walls were all identical, consisting of a top and bottom two-inch-by-four-inch plate and eight-foot studdings placed sixteen inches on center with horizontal cross braces between studding. The frame construction is shown in Figure 2; the top and bottom plates were nailed to the ends of each stud by two 20d nails, the cross bracing being nailed in the same manner with 16d nails.

The eight-inch, fir sheathing was nailed to each stud with two 8d common nails, each placed at ap-

The celotex was nailed to each stud with one-and-one-half-inch, 8d, roofing nails spaced four inches apart. At the border of the sheet, the nails were driven three-eights of an inch from the edge of material. All nails were driven flush with the surface; the only difference in the finished walls was in the sheathing used.

Comparative Strength Sought

Since the object of these tests was to determine the comparative strength of the wall sections, they were arranged in such a manner as to subject them to a diagonal shear. The lower plate was bolted securely to a vertical column and a vertical force was applied to the end of the top plate, which was the lower outside corner of the wall as placed in position for test. The loads were applied with a jack screw and scale, as shown in Figures 1 and 2. Figure 1 shows the condition of the wall covered with horizontal sheathing before and after the test, while Figure 2 shows the same for the diagonal sheathed walls. The horizontal line drawn on each wall shows the distortion of the wall.

Walls covered with celotex sheathing were given the same test both in a dry and a wet condition. Tests were made on the wet celotex to determine what effect an extended soaking of the surface would have on the strength of the material. In order to subject the walls to a condition which would be at least as severe as any rainstorm on the material after it was placed on the wall and before it was covered with an exterior finish, the celotex-covered wall was placed in a vertical position, a spray of water was directed against the surface for twenty hours, and the test was made immediately after the water was turned off. The spray was produced by four spray heads placed in a rectangular position and spaced six feet apart horizontally and four feet apart vertically, six feet in front of the wall surface. The object of this arrangement was to secure a uniform wetting of the surface. It was found, however, that some of the lines of spray directed against the surface did not break up but pounded the surface in spots and gave a more severe condition than would be met in practice.

Series of Four Tests Conducted

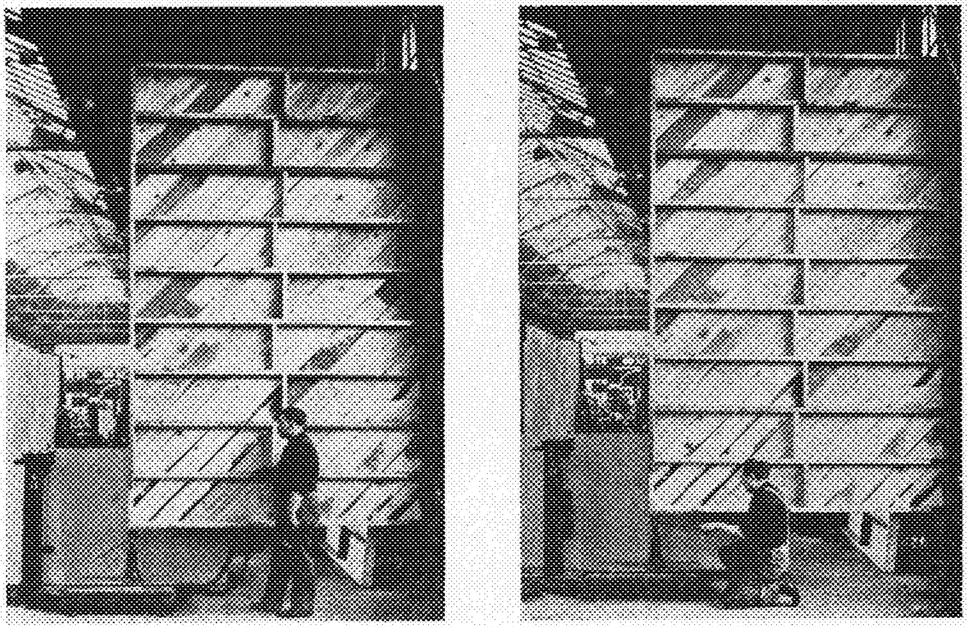


Fig. 2. Frame Construction of the Walls; Diagonal Sheathing

the tabulated data and curve of Figure 3. In the curves the ordinates show the load in hundreds of pounds on the scale and the abscissae the displacement of the outer edge of the wall in inches. These results show the comparative strength and stiffness of the wall as follows: 1st, diagonal sheathing; 2nd, dry celotex; 3rd, wet celotex; 4th, horizontal sheathing.

At the 1,000-pound load, the deflection of the horizontally sheathed wall was approximately ten times as great as that of the diagonally sheathed wall, about three times as great as that of the dry celotex, and over fifty per cent greater than that of the wet celotex.

Other tests were made with the same comparative results, showing that the accepted method of applying wood sheathing to walls is very inferior in point of strength and stiffness when compared with diagonal sheathing or with celotex as a substitute. It will be noted from the data that the tests on the horizontal sheathed wall were carried to a deflection of five inches. As a matter of fact, practical failure of a wall would occur long before this deflection was reached.

Effect of Absorption Shown

In order to determine the amount of water absorbed by samples of celotex used in the wall construction, and also the effect of repeated soaking and drying of the material, two tests were made, the first to determine the amount of water absorbed and the second the effect of soaking and drying the specimens. In the first test, a standard 4-foot-by-8-foot sheet was used. Metal points were placed securely in the board near each corner to determine the exact dimensions of the board before and after the test. The points were projected through both surfaces of the board, and in determining the distance between the points, the measurements were taken on each side of the board and averaged. The board was set in a vertical frame so that it was supported in an upright position without protecting the sides. It was then put in a spray or moist room, the spray was turned on, and it left there for 24 hours. The spray room was 8'-0" x 1'-0" floor area by 6'-6" in height, and was equipped with two spray heads uniformly spaced in the ceiling in order to give a uniform spray or mist throughout the room. The following results were obtained: weight of sheet before test, 17.44 lbs.; weight of sheet after test, 21.46 lbs.; water absorbed, 4.04 lbs.; percentage based on dry sheet, 23.7 per cent.

This test shows absorption of 23.7 per cent by weight, an elongation lengthwise of the board of .278 per cent, and crosswise elongation of the board of .478 per cent.

The second test, which consisted of repeatedly soaking and drying the celotex, was made on a 4' x 8' wall panel constructed the same as the large sections for the strength test. The outside surface of the material was thoroughly sprayed and then dried in front of a hot steam coil. The spray arrangement was similar to the one previously described for 8' x 12' wall sections.

Spray Loosened Surface Fibres

The wall was sprayed and thoroughly dried three times. In each case the board bulged slightly between the studding, but came back to its original position when dried. The only apparent effect of

(Continued on page 32)

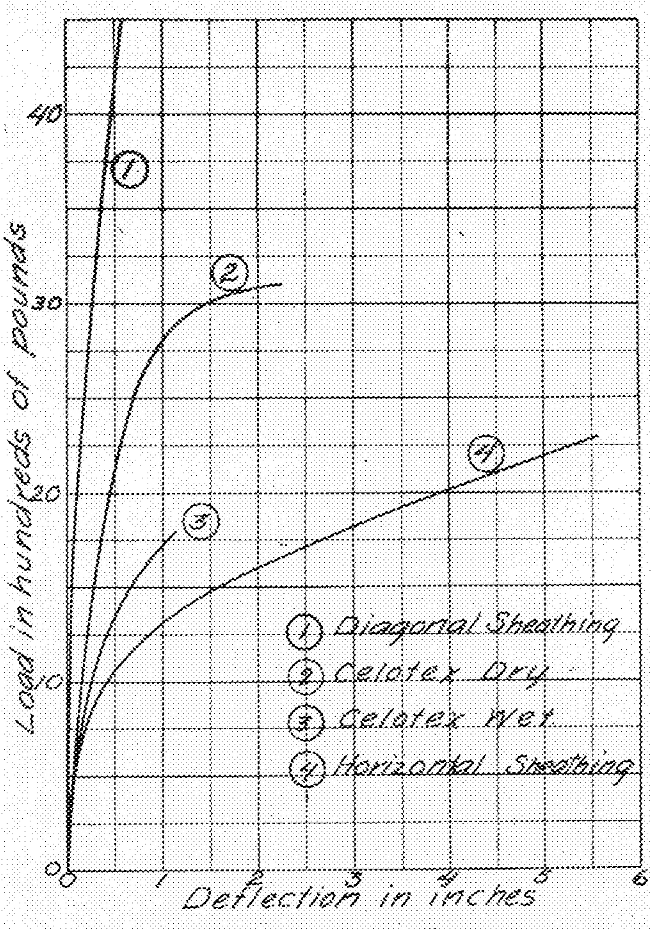


Fig. 3. Results of Four Tests

RECOGNITION OF ENGINEERING GENIUS

Recording Names of Designers and Builders in Tablet Form Would Perpetuate Their Memories

By Charles R. Shepley, B.S. in C.E., '02

EVERY man, to be worthy, must have a deep-rooted incentive, and all engineers and architects in the precincts of their budding genius should look out and forward to some measure of appreciation for their efforts.

Knowledge, achievement and reward should successively crown their efforts, and by reward I mean not only monetary reward but the reward of gratitude for a service well performed.

How few engineers and architects realize this greater reward of public gratitude is evidenced by the lack of association between the designer or builder and the edifice upon which his skill and untiring effort is expended.

The vastly superior appeal of capital has thus far overshadowed the technical genius and fairly buried him in this over-commercialized age. You and I may know who was the architect of the Woolworth Building in New York, but of the teeming multitude who gaze awe-struck upon its towering pinnacle, few allow their thoughts to dwell upon anything but the marvel of so great an accomplishment raised with the lowly dime to proportions of unexcelled splendor.

How Many Masterpieces Credit Builders?

How many of us know the name of the great French engineer who laid out the pattern of the City of Washington, the most beautiful city in our country? How many of the engineering and architectural masterpieces of this country give credit in permanent form to their designers and builders?

Is this laxity due to the over-modest ethics of the profession, or to the indifference of the public mind? Personally, I am inclined to believe it is the fault of the professions, and that it could be remedied by a demand in every specification requiring a permanent record engraved or recorded in tablet form upon every engineering or architectural effort, whereon should appear at least the names of its designer and builder. What an added incentive this would be to realize the creation of something enduring and inspiring; some edifice, some great bridge, some tunnel, that would mark the designer and builder and their production for all time. This would effectively realize the "port of dreams" of many of you and give you some greater incentive to achieve in the years of study and acquirement of experience which lie ahead of you.

It is not my purpose to be "technical" in this article, but rather to suggest some way to make ourselves felt, to force the public to accord to our certain rights too long unrecognized, which any fair-minded age should accord to any permanent achievement.

Not long ago, standing upon the bank of the Potomac River, where it comes majestically past the City of Washington, I gazed upon the two marvelous memorials to Washington and Lincoln.

It happened to be what one might term a lazy day. The air had in it a stirring of spring, and yet seemed reluctant to part with the crispness of winter. It was a bright morning; yet there lay across the wide reaches of the Potomac a faint haze, as though the sun, even in early March, were drawing into the heavens some moisture from the broad river and the tidal basins.

The trees were bare, but showed signs of struggling from their winter lethargy into bud. Their stark limbs formed a delicate tracery against the grayish white monument of Washington.

Very few people were abroad, and the whole scene was quiescent, even brooding under the passing clouds, for upon the earth no breath of air seemed to stir. It seemed as if nature had conspired to bring this lull into being so that the senses could more fully appreciate the grandeur of the scene and hallow the moments of its appreciation. Awe-struck, I gazed upon these monuments of man to man, first upon the stately spire of Washington's monument, and then upon the majestic white marble memorial to Lincoln.

Somehow it seems that the privilege of standing before these structures and absorbing the beauty of this scene were a boon to any man and a spiritual bath to any citizen or alien.

I have visited that dismal rotunda of Grant's Tomb on Riverside Drive in New York City, and gazed down upon those twin receptacles, wherein lie the remains of Ulysses S. and Julia Dent Grant, and I have stood beside the tomb of the Unknown Soldier in the Arlington Memorial Cemetery, but the impressions were not as vital, the sorrow was somewhat less poignant, and the settings did not stir the soul with quite the same appeal of thankfulness as did these memorial masterpieces of the Washington Mall.

Of course, a more extensive knowledge of the lives and accomplishments of Washington and Lincoln doubtless deepened my respect and made me thankful that the reverence of millions of others like myself had reared these temples of worship, and made here in Washington "under the wide and starry sky" a perpetual shrine for the pilgrimage of a free people.

Tidal Basins Reflect a Thousand Beauties

It had been my privilege to make the trip to the top of the Washington monument on Washington's birthday in the year nineteen hundred and seventeen, and at that time, looking far across that portion of the mall where the mirrored waters of the Tidal Basins now reflect a thousand beauties of earth and sky, I beheld upon the bank of the Potomac the Lincoln Memorial Building in course of construction. Even then the majesty had assumed its present proportions, but its approaches had not been filled in with earth and graded, and the whole edifice seemed to the distant observer to have been erected upon a raised platform whose formidable height seemed to discourage the mind and the eye to an appreciation of its possibilities.

A little over seven years had passed since that day and now I looked upon the completed edifice and its wonderful approaches, upon its temple har-

(Continued on page 28)

ARABS WILL PRESENT "RIQUIQUI"

First Road Trip of Organization Planned to St. Cloud on April 26

By Kenefick Robertson

THE Arabs will present their third annual production, Riquiqui, in the Auditorium of the Music building on the evening of April 17 and at matinee and evening performances on April 19; on April 26, matinee and evening shows will be given in the Sherman theatre of Saint Cloud. The club reaches another milepost in its theatrical progress!

"Riquiqui" comes from the pen of Glanville Smith, the author of "The Blue God," which the club produced so successfully last year. A senior in the Department of Architecture and a prominent figure in campus dramatics, Mr. Smith offers in this play a fitting monument to his University career. His plays are light and airy and are permeated with a color of local humor. In "Riquiqui" as in "The Blue God," he develops his plot from the everyday life of a technical student, finds humor in class and school life, and presents the theme in a manner which neither bewilders the layman nor bores either faculty or students.

Glanville W. Smith

In the three years of its existence, the Arabs Dramatic Club has produced on the campus two musical extravaganzas whose success has been clearly shown by the comment of campus play fans. In April of 1922, the club made its debut by presenting "The Caliph of Colynos" in the University Armory under the trying circumstances usually hindering the first effort of a dramatic club. The staging of this play opened a new era in University dramatics: it demonstrated that students could independently produce a musical comedy or a light opera. Not a bit of the work from the composition of the play and the musical numbers to the leading of the orchestra was done by anyone except club members! A style show with engineers taking the places of professional models was a feature of the 1922 presentation, and the play was successful in every respect, and started the Arabs on what has proven to be a successful career.

Last year "The Blue God," which we have previously stated is a product of the prolific pen of Glanville Smith, was presented in the music auditorium. The production was marked by its unsurpassable staging, exotic song hits and a delicate touch of comedy in both play and lyrics. Both the vocal and instrumental music was described by critics as of great credit to both the Arabs and the University.

A particular effort has been made by the Arabs since the founding of the club to excel in scene design, costuming and stage technique. A critic reviewing "The Blue God" said, "the Arabs possess more scenic possibilities than any other dramatic group on the campus, and they have worked to give them to us in this production." This is similar to the comments of others who expressed their views of the play. What was true of the staging of "The Blue God" was equally true of the staging of "The Caliph of Colynos." Because the initial production of the Arabs was given in the age-old Armory, the task of supplying certain scenes was made doubly hard, yet the undaunted Arabs accomplished the seemingly impossible, and gave a setting for the play that was masterfully executed both from a mechanical and artistic viewpoint.

Lighting effects in former Arab plays have been praised by many critics commenting on the productions. This has undoubtedly been inspired by the delightful interplay of lighting effects with the dramatic action. By the use of the proper lights at the correct time, effects are given which determine the mood of the audience equally as much as the orchestral accompaniment. All the mechanical and electrical results were much harder to obtain in the Armory than the following year in the newer Music Auditorium. However, the lighting for "The Caliph of Colynos" was very nearly perfect. Richard Jones, who handled the electrical effects for "The Blue God," promises to give even better lighting service for "Riquiqui."

The recent announcement that "Riquiqui" will be given at both afternoon and evening performances in Saint Cloud the week following its presentation on the campus marks a new era in the history of the club. It opens the possibility of road tours for the club. The success in Saint Cloud will be made possible by the co-operation of Mr. W. W. Smith of that city, father of Glanville Smith. This undertaking will undoubtedly determine the attitude of the club toward future trips over the state and country, and may influence the adoption of the policy of many university and college dramatic clubs throughout the country who make annual interstate tours with great success.

Not a little of the success of the Arab Club has been due to the music that makes up an important part of their plays. Songs are written by active Club members to fit the dramatic action, and the ability of the principal actors. The hits are written for solo, group, and chorus work, as the action of the play dictates. With a combination of subjects to fit the play and skillful composition, the music becomes a most important asset. What is true of the vocal music is also true of the instrumental. A complete orchestra, consisting of twelve or more pieces played by technical students under the leadership of one of their classmates, rendering music creditable to a much more experienced organization, reflects credit upon the University and College. This year the club promises a musical accompaniment harmonizing with the odd and peculiar setting of "Riquiqui."

Clarence W. Teal, president of the Arabs this year, took important parts in both "The Caliph of Colynos" and "The Blue God," and will take a

(Continued on page 30)

MANY ALUMNI ON COLLEGE FACULTY

Approximately One-sixth of Our Engineering Instructors Are Minnesota Men

By Julian Garzon, C.E., '24

Formerly Alumni Editor of the Minnesota Techno-Log

NO doubt you have listened to your instructor on various occasions and said to yourself, "Where did he get that idea?" About thirty, approximately one-sixth, of the instructors in the colleges of engineering at the University of Minnesota are Minnesota alumni and got the foundation for "that idea" while they sat "even as you and I." Some of our instructors came back to Minnesota from classes which graduated as early as 1890; others are from the class of '23. They are to be found in every department of the engineering colleges.

In the civil engineering department we have A. S. Cutler, professor of railway engineering. Professor Cutler graduated in the class of 1905, and came to Minnesota in 1907. Outside of his school work he has been employed by various railroads in the capacity of division engineer and also as valuation engineer on maintenance and construction. Professor Cutler is a member of Sigma Xi, Tau Beta Pi, American Society of Civil Engineers, and the American Railway Engineers Association. Every civil engineer who graduates from Minnesota comes in contact with Professor Cutler during the summer camp.

Math. Department Has Largest Number

The department of mathematics and mechanics has the largest number of Minnesota men. We have our old friend Hans H. Dalaker, a graduate of the S. L. A. college, class of 1902. Hans (this name is to be used by only those who have become so intimate as to receive a flunk at the hands of this instructor) came to instruct the boys immediately after his graduation and has risen to the rank of professor. He is a member of Phi Beta Kappa, Sigma Xi, American Mathematical Society, and the Society for Promotion of Engineering Education.

A man who graduated in 1902 from the mechanical engineering department is C. A. Herrick. He is an assistant professor of mathematics and mechanics, is a member of Sigma Xi and Delta Upsilon, and has been with us since 1918.

R. R. Herrmann graduated from the electrical engineering department in 1913 and returned to Minnesota in 1919; he is assistant professor of mathematics and mechanics. Prior to his return to Minnesota, Mr. Herrmann was employed by the Western Electric Company in New York City. He is a member of Tau Beta Pi, Acacia, and Theta Xi.

H. B. Wilcox graduated, an E.E., in '14. Mr. Wilcox, who is a good story teller and an excellent mathematics instructor, has been with us for four years and is assistant professor. Before coming to Minnesota, Mr. Wilcox was an examiner in the United States Patent Office. He is a member of A. S. M. E., American Mathematics Society, Society for Promotion of Engineering Education, American Association for Advancement of Science, American Mathematics Association, and Tau Beta Pi.

E. W. Johnson is another electrical engineer who is helping keep the boys busy. He graduated in 1915, and came back to Minnesota in 1921 to instruct us in mathematics and mechanics.

Charles Boehnlein graduated from the mechanical engineering department in 1917. During the war, Mr. Boehnlein was in the service of the government, working in the aviation department. He is now an instructor in the department of mathematics and mechanics.

Henry E. Hartig graduated from the department of electrical engineering in '18, and came back to Minnesota in 1919. He is an instructor in the department of mathematics and mechanics. Mr. Hartig has been with the American Telephone and Telegraph Company as research engineer. He is a member of Tau Beta Pi and Theta Xi.

Oscar C. Lee graduated in the electrical engineering class of '19, and returned to Minnesota as an instructor in the department of mathematics and mechanics in 1920. He has been with the Electric Machinery Company of Minneapolis as assistant engineer. Mr. Lee is a member of Tau Kappa Epsilon and Tau Beta Pi.

The department of drawing and descriptive geometry has only two Minnesota alumni on its staff. Orrin Weston Potter graduated from the college of mines in 1914, and after five years of practical work began the task of instructing boys in drawing and descriptive geometry. Mr. Potter has been with the Northwestern Steel and Iron Corporation, where he was manager of the works.

A more recent addition to the department of drawing and descriptive geometry is Alex S. Levens, who graduated from the civil engineering department in '22. Mr. Levens became an instructor in the fall of the same year. He has had experience as a draftsman with the Western Union Telephone Company, as bridge inspector and designer with the M. & St. L. Ry., and has served in Hennepin County as a deputy county surveyor. Mr. Levens is a member of Tau Beta Pi.

Every student of civil engineering during his Junior year meets Fred C. Lang as an instructor in highways and pavements. Mr. Lang graduated a civil engineer in 1908. He is with the State Highway Department as engineer in charge of tests and inspections. Since graduation, Mr. Lang has gathered experience with a number of firms. He was with the United States Reclamation Service as instrument man, for a time he was city engineer of Chisholm, Minn., was with the E. W. Coons Company of Hibbing as engineer and construction superintendent, was instrument man and draftsman of the Oliver Mining Company and was chief engineer of the Central Creosoting Company. Mr. Lang is a member of the American Association of Highway Officials and the Engineers Club of Minneapolis.

Sampson Is Latest to Join Electrical Staff

M. E. Todd graduated from the electrical engineering department in 1909. A short time later, he returned to instruct the boys, and is now assistant professor of electric power engineering. Mr. Todd has taught electrical engineering at the Dunwoody Institute. He is a member of the following Societies: The Society for Promotion of Engineering Education, A. I. E. E., Minneapolis Engineers Club, and the Twin City Radio Council.

Reaching more recent times, we have the year 1917, in which G. W. Swenson was handed a degree in electrical engineering. Mr. Swenson came back to Minnesota the following year to take up the duties of instructor in telegraph and telephone engineering. He has been with the Western Electric Company as equipment engineer, and is a member of A. I. E. E. and the Glee Club.

So recently has Clifford L. Sampson become an instructor in the department of electrical engineering that he has yet to be thought of as an instructor of students. He graduated last year, and immediately took up his duties at Minnesota. We feel that in a few years more space will be needed when he is written up in the Minnesota Techno-Log.

Civil Dept. Small When Prof. Mann Graduated

The civil engineering department was not very large in 1890, when Fred H. Mann received his degree. After graduating from Minnesota, he worked for the Northern Pacific Railway as a topographer and draughtsman, but later entered the field of architectural engineering. Professor Mann has during his career been an instructor in architecture at the University of Pennsylvania, a professor of architecture at the University of Washington and the University of Illinois, and has also practiced architecture in Philadelphia. He is a member of the Minneapolis Engineers Club, Sigma Xi, Alpha Rho Chi, Tau Beta Pi, Tau Sigma Delta, and Psi Upsilon.

In the department of architecture, we have John W. Dawson, Architecture '22. After graduation, Mr. Dawson worked as a draftsman for Hewitt and Brown, but he decided to come back and do a bit of instructing at Minnesota.

B. J. Robertson graduated in 1914, and received his masters degree in 1915. After graduation, he was employed by the Lyle Culvert and Road Equipment Company as department manager. The University was fortunate in securing Mr. Robertson in the capacity of assistant professor of mechanical engineering and assistant director of the mechanical engineering laboratories. He is a member of Tau Beta Pi.

George L. Tuve, M. E. '20, has been with us as an instructor of mechanical engineering since his graduation. He conducts the boys about the campus so that they can get an idea of the university heating system, and all in all presents a much cussed and discussed course in heat engines. Mr. Tuve has had practical experience with the American Locomotive Company as inspector of materials, the Mahr Manufacturing Company as research engineer, and The American Plumbing and Heating Company as consulting engineer.

Lagaard Worked on First Concrete Ship

M. B. Lagaard, C. E. '14 and '15, is assistant professor of structural engineering. At the present time, he is working on the plans for our new stadium. During the war, he was employed by the government as concrete engineer, and was connected with the Bureau of Public Roads and the U. S. Shipping Board. Mr. Lagaard worked on the designing of the first concrete ship to be launched by the government, the "Atlantis." He is a member of the American Society for Testing Materials, the American Concrete Institute, and the Minneapolis Engineers Club.

Dowdell Employed by Government During War

R. L. Dowdell, Mines '18, returned to Minnesota the same year he graduated, and became an instructor in metallography. During the war, Mr. Dowdell was an assistant metallurgist in the employ of the government, working on manganese war problems. He is a member of Sigma Rho.

A. J. Carlson, Mines '16 and '17, is assistant professor of mine plant mechanics. His professional record shows that he has been an assistant surveyor in Renville county, assistant engineer for C. W. Gove, assistant engineer for the Northern Pacific Ry., and an employee of the Minnesota Tax Commission. Mr. Carlson is a member of the Minneapolis Engineers Club, the National Geographic Society, the Minneapolis Institute of Arts, Tau Beta Pi, Alpha Sigma Phi, Sigma Rho, and Alpha Tau Omega.

Peter Christianson graduated in the early days of Minnesota. He received a degree from the S. L. A. college in 1890, one from the College of Mines in 1894, and one from the department of mechanical engineering in 1898. He is now a professor of metallurgy. Professor Christianson has spent considerable time in the study of the metallurgy of iron and steel.

C. M. Reasoner, M. E. '20, is an instructor in the department of metallography. He has spent some time in the employ of the Western Electric Company. Mr. Reasoner is a member of Tau Beta Pi.

Prof. Maney Now on Leave in Texas

In the structural engineering department, we have George A. Maney, who graduated in 1911. Professor Maney is now on a leave of absence from the university. He is directing the construction of a concrete building in Dallas, Texas. This building is one of the largest concrete structures which has ever been attempted. Professor Maney has been connected with the designing of many large concrete structures in Minneapolis and throughout the country.

Professor William T. Ryan, E. E. '05, is professor of electrical engineering. After having spent two years with the Westinghouse and General Electric Companies, he came back to Minnesota in 1907. Since December, 1921, he has supervised the valuation of public utilities properties for the Minnesota Tax Commission. He is president of the Engineers Club of Minneapolis.

Just 31 years ago F. W. Springer graduated from the electrical engineering department; that was the class of '93. He is now a professor of electrical engineering. It would take a lot of space to go through the list of Professor Springer's activities since he graduated from Minnesota; we refer you to the publication of "Who's Who." Professor Springer is a member of A. I. E. E., the Society for Promotion of Engineering Education, Sigma Xi, Tau Beta Pi, Delta Upsilon, and Alpha Kappa Sigma.

RESULTS OF THE PITTSBURGH TEST

Corrosion of Iron and Steel Stimulates Scientific Investigations to Find Causes

By J. D. Frazer

THE tremendous loss from corrosion of iron and steel has stimulated a great deal of investigation as to the causes underlying corrosion. The electrolytic theory has been pretty well established as the scientific explanation of corrosion and a number of man-made tests have been initiated and carried through with a view of feeding the beast of corrosion in order to study its habits. Pre-eminent among these undertakings is the so-called Pittsburgh Test which was begun a number of years ago under the auspices of the American Society for Testing Materials. Unfortunately the results of these tests have been seized upon by various commercial institutions and submitted to the public in garbled, incomplete and inaccurate form. The society itself has repeatedly gone on record with the statement that no definite and accurate deductions could be drawn from the tests because of the many contradictions its results contained. Like any scientific investigation it is necessary that all the results be recited or none, and a partial statement of results oftentimes leads to misconceptions and erroneous conclusions.

Tests were carried on under two conditions and in three locations. Ungalvanized light gauge sheets of commercially pure iron, commercially pure iron with copper in small quantities added, Open Hearth steel with and without a copper content and Bessemer steel with and without copper content. In the first place sheets were exposed to atmospheric corrosion at Pittsburgh, Pa., Annapolis, Md., and Ft. Sheridan, Illinois. Pittsburgh, with its sulphur-laden atmosphere was presumed to represent an industrial condition. Annapolis, because of its location at seaboard, represented tide water conditions and Fort Sheridan was presumed to represent a typical rural condition. There may be some question as to whether the latter named location was truly indicative of a rural condition because of the close proximity of Ft. Sheridan to the city of Chicago, which, of course, has a rather damp, sulphur-laden atmosphere.

Simultaneously with these atmospheric exposure tests, immersion tests were also carried on. Small samples were cut from the sheets exposed in the atmospheric tests and these samples were set in boxes in three different locations. Among these locations was the Calumet Mine in Pennsylvania where the samples were immersed in water pumped from the mine. An attempt was made to simulate an acid, alkaline and neutral condition in these tests also. The rule laid down was that when a hole was eaten through a sheet, that sheet should be considered a failure.

Bessemer Mixture Gives Best Results

It was found, as a whole, in the atmospheric exposure tests that the addition of copper to a sheet retarded corrosion but it is significant to note that the copper bearing Bessemer steel displayed the best service record of any of the sheets in the atmospheric corrision tests. Since it is generally recognized that Bessemer steel normally displays the least resistance to the corrosion of any sheet steel, it would seem that the results of the test contained a contradiction of the facts as displayed in actual service. In fact, at the present time, Bessemer steel is produced only in very small quantities because of the poor service it has given.

In the immersion tests the results were diametrically different. All samples containing copper showed a lower service life than the pure iron without copper. To quote from the report of Sub-committee V of Committee A-5, "It must be remembered that these test pieces (referring to the test pieces exposed at the Calumet Mine) are cut from the same sheets which are exposed in the atmospheric tests and, by comparison with the groups which have failed in the atmosphere, it will be noted the results are quite different. In the immersion tests, under the conditions which prevailed in the Calumet Mine, the presence of copper would indicate little influence on the life of the specimen and, if any difference, the presence of copper would seem to give a slightly shorter life."

Condition of "Merrimac" Cited as Example

It is also very interesting to observe other contradictions which this accelerated test displays. It was found that in the atmosphere at Pittsburgh high copper puddled iron sheets failed in twenty-two months and low copper puddled iron sheets failed in twenty-eight months. These results obviously would condemn iron either with or without copper whereas it is a well known fact, under many diverse service conditions, these irons have outlasted steel. A very striking example of the life of puddled iron is that of the armorplate of the Gunboat "Merrimac" which was in a very good state of preservation after having been in salt water for more than half a century. In fact, as we contemplate this test, we are constrained to agree that the German method of testing under actual service conditions is by far more accurate in results. Professor Bauer carried on extensive experiments which include tests made by burying the sheets in various kinds of soil as well as testing in different waters and atmosphere. His conclusions are drawn in the German metallurgical magazine "Sthal Und Eisen" for January 13, 1921.

"Rust experiments in distilled water, in tap water and in the North Sea water, showed that copper content was without influence on the speed of rusting."

Again the institution of Civil Engineers, England, Proceedings, Session 1921-1922—Sir Robert Hadfield:

"The investigation comprises 14 types of ferrous material prepared for the corrosion committee, represented by 1,330 separate specimens. As a general summing up, it is considered from the investigation that the addition of copper to steel for the purpose of preventing or mitigating corrosion would not generally be advisable."

If an ordinary piece of Open Hearth steel is immersed in a hot 25% solution of sulphuric acid, it

(Continued on page 30)

ALUMNI NEWS

In the hope that we can locate a number of "lost" engineers, we will publish a list of names in each issue of the Techno-Log. These are names of men who have changed their mail address and of whom we have no location record. The Techno-Log and the dean's office are desirous of keeping a complete and up-to-date record of our alumni. If you have any knowledge concerning these men you are urged to send it to the alumni editor of the Techno-Log.

Civils:
Benjamin W. Adams, '10
Raleigh W. Hosfield, '12
Alexander B. Johnson, '15
James McKittrick, '01
William G. Peters, '83
John R. Price, '14
Louis O. Smith, '83
Adolph A. Sommerfeld, '10
Arthur C. Walby, '11

Electricals:
Timothy G. Arenson, '16
Samuel A. Berg, '21
John P. Calmeyer, '06
Roy Kauffman, '08
Nathaniel R. Mori, '17
Robert Morris, '05
John H. Pearce, '07
William F. H. Schildt, '08
Ernest E. Skytte, '10

Mechanicals:
George L. Andrews, '05
Nicholas A. Gilman, '07
Percival Hetherton, '08
William W. Johnston, '00
Frank J. Kircher, '09
Walter G. Krag, '07
Eric H. Loe, '88
John W. Nekola, '07

CIVILS

Oscar F. Woodrich, C. E. '08, is head of his own concern, the Woodrich Construction Co. of Minneapolis. This company specializes in municipal contracting.

Another general contractor in Minneapolis is **Ingwald Kvitrud,** C. E. '11. Ingwald's particular line of work is building construction.

Henry J. Manger, C. E. '23, is a draftsman for the Northern States Power Co. at Minneapolis.

When **L. Morris Mitchell,** C. E. '15, left school, he started out as assistant engineer of maintenance and construction for the M. & St. L. Ry. Later he did some special work on the Chicago Lake Shore Improvement Project. From railroading, Morris turned to design and construction, and is at present working for Naufits & Bergstrom, gerenal contractors, at Duluth.

We are again glad to remind ourselves that **George M. Shepard,** C. E. '09, is Chief Engineer of Public Works and City Engineer for St. Paul.

Paul I. Gunstad, C. E. '01, is County Highway Engineer for Becker County. His headquarters are at Detroit, Minnesota. Previous to this job, Paul was doing valuation work on the N. P. Ry. and the G. N. Ry.

William P. Tarbell, C. E. '22, is engineer on sewer and waterworks construction in Fargo, N. D.

George I. Hayward, C. E. '06, began work in 1906 as a rodman for the N. P. Ry. Now George is Assistant District Engineer with headquarters at St. Paul.

Benjamin Wilk, C. E. '14, is in the Service Bureau of the Universal Portland Cement Company. To show the superiority of the engineer, the Minnesota Alumni in Illinois, under the direction of "Ben," raised more money for the Stadium-Auditorium Fund than was raised in any other state except Minnesota. "Ben" is Secretary of the U. of M. Alumni Association of Chicago.

Norman E. Hendrickson, C. E. '16, is an estimator for the Kalman Steel Co.

Carl E. Ekberg, C. E. '15, is designing, estimating and inspecting in the bridge department of the N. P. Ry.

Here's a sad case of an engineer gone wrong: **Roy Gilbert,** C. E. '20, entered the Medical School of the University of Michigan in 1921. He is to receive his M.D. in June. What must be, must be, I suppose, so "Good luck to you, Roy."

The address of **Seymore Crey,** C. E. '22, **Leo Buhr,** C. E. '22, and **George Guesmer,** C. E. '23, is Danbury, Wis. Jim Darrel, C. E. '23, and H. J. Manger, C. E. '23, are located on the Mississippi River, two miles above Monticello, Minn. All these men are working for the Northern States Power Co.

"Bill" Kelly, C. E. '22, is at Grantsburg, Wis.

Hans J. Asleson, C. E. '10, is designing for special jobs such as coal handling equipment and gantry cranes in the sales department of the Minneapolis Steel & Machinery Co.

William F. Biskup, C. E. '16, is also working in the Minneapolis Steel & Machinery Co. His specialty is concrete reinforcing.

The U. S. Army boasts **Edward H. Coe,** C. E. '19, as a first lieutenant. Immediately after leaving school, Ed was an organizer of the University of Minnesota Extension Division. Ed is located at Ft. Humphrey, Va.

E. R. Grant, C. E. '24, is going to work under J. Lief Sverdrup, C. E. '21, in the bridge department of the Missouri State Highway Commission.

Martin Nelson and **Clifford Stoner,** both C. E. '24, are going to do field work for the Southern California Edison Co.

Two other C. E. '24's, **Roscoe Bauer** and **M. V. Harrington,** are stepping into the U. S. Engineering Corps with headquarters at Milwaukee, Wis.

Paul Swanosn, C. E. '23, has left the valuation department of the G. N. Ry. He is now with the Concrete Engineering Co. at Milwaukee, Wis.

We received a letter from **Charles R. Shepley,** C. E. '02, giving information about two of our "Lost Engineers." Charles is a contractor in the Twin

Cities, and he is living at 2607 Chicago Avenue, Minneapolis.

William A. Cuddy, C. E. '16, is an auditor for the Standard Oil Co. At present he is located at Madras, India, but he is expected home during the summer or fall.

Philip L. Dahlquist, C. E. '10, is a member of the firm of Peterson-Dahlquist, Engineers, Chicago. This company does general construction engineering but specializes in the design and detail of bridges and buildings. Since leaving school, Phil has done designing and field inspection for W. P. Cowles, Consulting Engineer, the U. S. Engineering Corps, the Scherzer Rolling Lift Bridge Co. and the Strauss Bascule Bridge Co.

E. F. Cummings, C. E. '13, is an engineer on Minnesota's Stadium. He has charge of the steel and the laying out of footings and forms, and is also giving elevations to excavators.

George Schaller, C. E. '23, is another alumnus working on the stadium. George is timekeeper, he checks material, and he assists the engineer in charge.

ELECTRICALS

On looking over the list of electrical engineering alumni, we find that the men who have made the most startling success, both from a financial standpoint and from the standpoint of worth while ideas actually carried out, are those men who have spent their time in research or in lines of work in which a knowledge of some non-technical subject must be combined with professional experience.

The most recent success that we know of is that of **Irving E. Aske**, E. E. '20, who before graduation took an active interest in such research work as could be done in the electrical laboratory, and who has spent practically all his time since leaving school on research regarding electrical devices for automobiles. His most recent contribution is the "As-ke Electric Fuelizer," which several of the largest automobile corporations in the country are now considering installing as a regular part of their equipment. The device has already been adopted to some extent by some companies. Furthermore, the apparatus has been found to be an ultra-fast seller as an accessory, which fact assures Irving a firm financial foundation "ad infinitum." The research departments of most of the large companies have attempted to design something for the purpose of heating cold kerosene or gasoline as it comes from the carburetor to a dry superheated gaseous state in order that it may explode readily. They have failed, because any electrically heated coil or grid has taken too much current and because, if the device is stretched across the intake, the passage of gasoline is so fast and the cooling rate due to the cold air so great that no results are noticeable. If the coil is submerged in the liquid, the gas or vapor formed by the boiling is condensed before it reaches the surface. Irving's device is a coil of suitable wire wound on a small porcelain frame so constructed as to afford a passage for the escaping gases. This coil is surronnded by absorbent asbestos which collects the liquid as fast as it is needed. The coil is operated in conjunction with the starter or choker and draws about thirty amperes, thus bringing the coil to a temperature of about 700° F. The whole apparatus is enclosed in a brass case fitted inside and tangent to the manifold. Viewing a demonstration set-up arranged so that the resulting gases are visible and can be collected, one is surprised at the rapidity with which the fumes are given off and at the slow rate of condensation. Aside from this "fuelizer," Irving has several other ideas which he is developing and which will undoubtedly turn out successfully.

David Grimes, E. E. '19, who did a great deal of research along radio lines while at the University, has had wonderful success in the practical development of broadcasting and reception. The Grimes radio hook-up, which has been mentioned in this magazine and which is well known to radio "fans," is a product of his efforts.

Arthur P. Peterson, E. E. '19, is a man who has mixed stenography, salesmanship and electrical engineering together with the result that he has an interesting position and a salary that many of us will never approach. We had news from him the other day. It seems that he is spending a short vacation in Havana, Cuba. On the way from Key West to Havana, Old Man Neptune treated "Art" to a little rough riding and seasickness, but now "Art" is having an interesting time visiting cigar factories and laughing at the recent Cuban street cars. Later, he intends to drive through the southeastern states and end up at Muscle Shoals in April. He has donated a one-year subscription to the "Electragist" to the electrical library.

We find a great many of the alumni are combining law with their engineering knowledge and are getting great results. **George M. Albrecht**, E. E. '06, is now an expert patent attorney for the Allis-Chalmers Company. He started out after graduation with the U. S. Patent Office as Assistant Examiner and studied law at night school. **Alex S. T. Lagaard**, E. E. '14, of the firm of Fischer and Lagaard in the Merchants Bank Building in St. Paul, is another alumnus who has made a success along this line. **Roy H. Olson**, E. E. '23, is also following up this kind of work, and, from the good rumors we have heard, he is going to make us take notice of him in the near future.

We have some news from the General Electric Company at Schenectady, N. Y. An intelligence test was given to the graduate students there. The average rating was 28%. **F. W. Wilson**, E. E. '23, was the only student to get 100%.

Roy Williams, E. E. '23, was here this spring representing the employment department of the General Electric Company. Seven electricals and two mechanicals were accepted for the plant at Schenectady. Seven electricals were employed for the Fort Wayne branch.

E. F. Johnson, E. E. '21, was here from his home town the other day. He is a radio retailer, electrical contractor, and part owner of his father's lumber mill. He says these little details keep him busy.

MECHANICALS

Wm. E. Acomb, M. E. '02, is superintendent of the Waukegan Works of the American Steel & Wire Co., Waukegan, Ill.

Helmer N. Anderson, M. E. '20, is sales engineer of the Worthington Pump & Machine Corporation of St. Paul. Mr. Anderson is a Tau Beta Pi. His residence is at 1757 Capitol Ave., St. Paul.

Howard B. Abrahamson, M. E. '18, has been with the St. Paul Gas Light Co. as engineer since November, 1922. During the war Mr. Abrahamson was in the navy and rose from coal passer to Chief Engineer. He also is a Tau Beta Pi.

After his graduation, **Roy Aure,** M. E. '22, accepted a position with the U. S. Radiator Corporation of Minneapolis, and remained with that company till March, 1923. He then entered the service of the Northern Pacific railroad of St. Paul as draftsman and is at present employed by them.

Arvid P. Carlson, M. E. '17, is engineer in the underground electric distribution division of the St. Paul Gas Light Co. of St. Paul, having been with that company since January, 1921.

John E. Morris, M. E. '09, is secretary and treasurer of the Stacy Bates Co., 817 McKnight building, Minneapolis. The firm manufactures and erects municipal incinerating plants.

Harold S. Morton, M. E. '13, is with the North Western Fuel Co., and has acted in the capacities of engineer of tests, combustion engineer, and assistant to general sales agent. His address is 108 Pierce St., St. Paul.

Marvin C. Barnum, M. E. '11, has been affiliated with the Northern Machinery Co. since 1914, and is now president of the concern.

Since his graduation, **Edward V. Brossard,** M. E. '23, has been employed as sales engineer by the St. Paul Gas Light Co. of St. Paul.

In a letter recently received from **H. C. Kelsey,** M. E. '23, we learned that he is with Jos. T. Ryerson and Son, Inc., of Chicago, learning the ups and downs of the machinery game.

Ernest F. Carlson, M. E. '22, is another Mechanical who has gone into power plant work. He started in March first doing efficiency work for the Northern States Power Co. at their Riverside plant. He was formerly employed by the Minneapolis Street Railway as boiler room engineer.

E. B. Curry, M. E. '20, visited the Mechanical Engineering school a few days ago. He has recently been put in charge of the autogenous welding for the entire Milwaukee Railroad, and at present has his office in Minneapolis in the Milwaukee station.

Arnold J. Nordenson, M. E. '22, is designing warm air, water, and steam heating systems for the Engineering Dept. of the Roberts Hamilton Co. of Minneapolis.

Leo E. Owens, M. E. '11, has proved the need of an Engineer in a modern printing establishment. He is mechanical superintendent of the Louisville Courier, Journal, and Times, at Louisville, Ky.

E. J. Hayes, M. E. '21, has advanced rapidly since he left school. On graduation he went to work with the J. G. Robertson Co. and is now chief engineer in charge of the erection of power plant machinery.

F. W. Hvoslef, M. E. '17, held a scholarship of the U. S. Radiator Corporation during a year of post-graduate work in 1919. Since graduation he has been employed in this company's plant in Detroit, doing general engineering designing, and also plant layout and construction supervising. While in school he was a member of Tau Beta Pi and Sigma Xi.

That the engineers are a versatile bunch is proved by the case of **B. P. Shaphard,** Mechanical Engineering graduate with the class of 1895, who has been practicing osteopathy in Portland, Oregon, since 1899.

H. R. Shellenburger, M. E. '20, is at present in Bombay, India, where he is employed as lubricating engineer by the Standard Oil Co. of New York.

The St. Paul Gas and Light Co. seems to draw a large percentage of our Mechanical graduates. **E. J. Forseberg** has taken their complete training course, and is at present working in the overhead electrical distribution department of that company.

Harold S. Chapin, M. E. '13, has opened a branch office for the Concrete Engineering Co. in the Builders Exchange Building, Minneapolis.

W. P. Richardson, Mechanical Engineering, 1899, has recently returned from a year's stay in China, where he has served as Mechanical Assistant to the Ministry of Communications of the Chinese Government. For the present, Mr. Richardson's address will be 622 Grand Avenue, St. Paul. For several years prior to his service in China, Mr. Richardson was with the Interstate Commerce Commission. Until this time, he has not visited the University since his graduation. He expressed great astonishment at the marvelous growth of the University, both as regards students and the development of the Campus. In his day, the entire work of the College of Engineering was contained in the old Mechanic Arts Building, now occupied by the School of Business. The old Shop Building in the rear of the Mechanic Arts Building, which is now being torn down as one of the oldest buildings of the University, was erected after Mr. Richardson's graduation. He stated that, although he had read of the growth of the University, he failed to realize its extent until he saw the present buildings and Campus.

AN ALUMNUS PASSES ON

Lewis Singer Gillette, C. E. '76, died at his winter home at Natchez, Mississippi, Sunday, March 30. Mr. Gillette was born on a farm near Niles, Mich., May 9, 1854. After he had finished high school, he came to Minneapolis and entered the University of Minnesota. In 1876 he graduated with a Bachelor of Science in Civil Engineering. In 1898, as a recognition of his professional skill, the University conferred upon him the degree of Civil Engineer.

After leaving school, Mr. Gillette went back to Michigan and, for a time, engaged in farming and stock raising. Soon, however, he became connected with the Niles Chilled Plow Works. In 1881 he returned to Minnesota as assistant right-of-way agent for the St. Paul, Minneapolis & Manitoba Ry. In 1894 Mr. Gillette entered the steel industry by purchasing a half interest in the Herzog Manufacturing Co., a firm engaged in the manufacture of structural steel. Later, with his associates, he organized the Minnesota Malleable Iron Co., and in the late '90's he was active in the organization of the American Bridge Co. Mr. Gillette was in charge of the division of the American Bridge Co. west of Chicago until the United States Steel corporation came into control of the firm. After a trip to Europe, Mr. Gillette took part in building the Red Wing malting plant and the electric steel elevator. This latter structure was one of the largest terminal elevators in the world. Mr. Gillette was an officer in the Metropolitan National Bank and, later, a director in the Northwestern National Bank. He was active in the organization of the Minneapolis Steel & Machinery Co. In regard to his last work, we take this note from his Alumni Record in the Dean's office, dated September 7, 1922: "I am no longer active. I only serve as an advisor in emergency. At present I am Chairman of the Building

(Continued on page 30)

EDITORIALS

ELECTRICALS WILL BE CROWDED

With a smile we note that three-quarters of the freshmen engineers have signified their intention of going into electrical engineering. The field is large and ever increasing in size, and our new facilities for study are the best in the country, but we are not equipped to take care of three-fourths of each incoming class. The new building can accommodate a larger number of students with ease but we question the desirability of this large number of first year men.

Here is a situation that must be met now before next fall's plans are under way. Two courses are open: to limit the registration in the electrical department, or to increase its teaching staff and cut the staff of the other departments. The first is what we feel is both desirable and necessary. There are many men who should be civils or mechanicals who have been convinced that they should be electricals simply because of the wonderful opportunities for study and research that are offered in the new building. Great publicity has been given, and justly so, to these new laboratories, and they deserve even more, but it must not be allowed to affect the strength of our other departments. Limited registration and a careful consideration of the men's likes and dislikes should determine their choice of specialization.

The older, more experienced men of the college could after a short conference tell whether the student was a good prospect as a civil, mechanical or electrical, and the passing on registration, we contend, should be in their hands.

We do not believe in making too much of a good thing, so let us hold the situation in check while we may, by limitation of registration.

C. W. T.

SOMEONE BLUNDERED

The recent filling in of the old N. P. right-of-way, which cuts through the campus, has shouted a warning to us. The day the steam shovel began to maneuver the dirt into the fill, another group began laying a sewer pipe along the side of the old roadbed. The pipe was being laid rapidly but one portion of its path was just as rapidly being piled with loose dirt. Thus it was that the men laying the sewer pipe had to spend a couple of extra days digging and barricading a small trench through this fresh dirt in order to complete the line.

"Someone blundered!" They surely did, and fortunately for the young engineer it happened within full view of the college. Will we profit by the experience of others?

A little planning ahead, a little co-operation with the other man, and the extra work in laying the pipe would have been eliminated. Out on your new job the same thing applies. The "boss" will not countenance such a clash between departments or between his operatives and those of an allied organization. Do not be overzealous and blunder on heedlessly, or someone may say that you blundered. (It is a well known fact that the "boss" doesn't like blunders.)

Of course you will make mistakes, but do not make the same one twice, and do not make the same one as your neighbor. Will you profit by the experience of others of which you have just been a witness?

Before taking up your problem, look ahead and see what difficulties you are likely to encounter, and then apply your practical knowledge of engineering principles. Consider the other man and his problem as well as your own. Show the world that you are a true Minnesotan.

C. W. T.

THE OLD ENGINEERING SPIRIT

On April 25th we are going to convince the rest of the campus that we are the livest, hardest working, and most thoroughly organized group of students in the University. The success of our undertaking rests not upon the chairman or the executive committee, it rests on you and on every other engineer in school. True, the Junior class is running the affair, but it is too large and too all-engineering in character for any one class to handle. We need the spirit, the work, and the enthusiastic co-operation of the Freshmen and Sophomores; we need the advice and encouragement of the Seniors.

Freshmen and Sophomores, it is up to you to make the parade the biggest and best ever led by Saint Patrick. To do this it is necessary that you, each one of you, plan new stunts and then work your head off until your idea is actually a part of the parade. On you, in great part, depends the success of the "open house." You will want to invite your parents and friends to see your college and you will want to show them what you have been doing there. You must provide the souvenirs of the occasion and help in the different exhibits.

Juniors, remember that it is your class that is sponsoring this event and that the biggest burden, that of management, is yours. There is a task for each one of you and by doing it quickly, thoroughly, and cheerfully you will aid in the scheme of affairs.

Let us all pull together and make this the biggest Engineers' Day ever held at Minnesota. Then you can throw out your chest and proudly say, "I am an engineer."

—J. E. Meagher.

The American people, who number 6 per cent of the population of the globe, use 63 per cent of all the telephones in the world.

One of the world's largest dams is being constructed in India to control the waters of the Indus for irrigation of vast tracts of land now unproductive.

COLLEGE NEWS

ARCHITECTS

This year's Architects' Jubilee is destined to be of greater magnitude and elaboration than ever before, since it marks the tenth anniversary of the founding of the department at Minnesota. It is to be a two-day affair: Friday, May 23, to be marked by a tea dansant in the afternoon and the Jubilee Costume Ball at night; and Saturday, May 24, marked by a banquet. Drawings both architectural and free-hand will be on display in the halls and the studio throughout the celebration, and the décors for the ball promise to be of a most daring and sumptuous description.

The playlet which will be enacted by the Freshmen as an interlude in the mad whirl of the ball has this year been written by Carl Matthias Wise. A restful variation from the customary king-and-queen business is displayed in the act, all of whose characters show a thorough modernity, being unlike those famous painted ladies in **The School for Scandal** "of whom it may be said that the head is modern while the trunk is antique."

To the Saturday's banquet will be invited all the architects of the state. Several prominent men of the profession are under consideration as chief speaker at this distinguished gathering.

The departmental Year-Book, biennial in its publication, is due to appear this spring. Photography is well under way, according to Wallace Bonsall, president of the Architectural Society, who is in charge of this work, and several proof-sheets testify to the handsomeness and practicability of the portfolio. A very attractive bit of lettering to serve as a cover design has been worked out by Mr. Bonsall.

MARCH DESIGN AWARDS

SENIOR SHORT

A Country House

Mentions:
- Mark L. Nelson
- E. W. Krafft
- E. E. Olson
- H. A. Magoon

SENIOR LANDSCAPE

A Country Estate

High Awards:
- Mark L. Nelson
- C. H. Hinman

SENIOR ESQUISSE-ESQUISSE

An Inter-state Bridge

Mention:
- Glanville Smith

INTERIOR DECORATION 4TH

A Ticket Booth

Mentions:
- Arthur Ruddy
- Helen MacGregor

JUNIOR LONG

A Music Studio and Residence

Mentions:
- R. S. Lantz
- P. P. Bross
- Dorothy Brink
- Everett L. Peterson
- E. W. Molander

JUNIOR SHORT

An Architectural School

First Credits:
- Everett L. Peterson
- D. T. Silver
- Dorothy Brink
- E. W. Molander

JUNIOR ESQUISSE-ESQUISSE

The Decoration of a Music Room

Credits:
- A. Gordon Lumm
- R. S. Lantz
- Alvin Jansma
- George Freeberg

SOPHOMORE SHORT

An Entrance to a Library

Mentions:
- Claude Flegal
- Mary Slocumb
- John Davidson
- G. A. Naslund
- Porter Kilpatrick

SOPHOMORE ESQUISSE-ESQUISSE

A Village Sign-Post

Credits:
- Porter Kilpatrick
- Clyde Lighter
- Wm. Lord

FRESHMAN DESIGN

A Pavilion

High Awards:
- L. W. Santo
- Lawrence B. Anderson
- A. P. Anderson
- Malvin Soldosky
- Gage M. Taylor
- Sidney L. Stolte
- K. A. W. Backstrom
- A. Frazin

CIVILS

THE MARCH GRADUATES

Although many may take exception to this statement the only real difference that I can see between a March and a June graduate in Civil Engineering is that the March graduate will starve to death three months sooner. We tentative June graduates often wonder whether or not we should have gone to summer school and thus have graduated in March. Some regret not having done so but a goodly share

(Continued on page 20)

CIVILS

(Continued from page 18)

are content with what they did. We are only sorry that the whole class could not have graduated together. Our six weeks of summer camp together at Cass Lake did wonders in bringing the class together and the spirit of brotherhood and companionship that was created there will never be forgotten.

The graduation festivities minus the formalities took place at the Minnesota Union on the evening of March 20, Thursday. In the absence of President Coffman, Dean F. J. Kelly, head of administration, conferred the degrees upon all the seniors of the different colleges who were eligible to graduation at that time. Chief Justice S. B. Wilson of the Minnesota Supreme Court was the principal speaker of the evening. Several days previous to this time Alumni Secretary E. B. Pierce made a touching speech to the Civil Senior graduating group and as a result the following members of the Senior Civil class passed out into the cold, cruel world with a 100% membership in the Alumni Association:

William H. Bachelder	Roy V. Lund
Roscoe W. Bauer	Martin E. Nelson
Mace J. Brody	Rolf Normann
Julian R. Garzon	C. Milford Olson
Herbert W. Gillard	Robert M. Parker
Elberth R. Grant	Louis H. Powell
N. Reeve Hankins	Donald R. Ranger
Marzy V. Harrington	George H. Sprehn
Claude E. Hayden	Hugh A. Stoddart
Morris B. Kaufman	Clifford M. Stoner
Peter L. Larson	

Many of these men have already scattered to the far corners of the United States. Some had definite positions to go to when they left and others are still seeking employment along their respectively chosen branches of the Civil Engineering profession. In a short time we hope to be able to publish in the Techno-Log the names and positions of these men. Archie McCrady, at a meeting of the whole group, was elected alumni secretary and will handle his job in his usual efficient and cheerful manner.

CHEMISTS

CHEMISTS MAKE ANNUAL PILGRIMAGE

Eyes are weary, feet are sore and pocketbooks are empty. The pilgrims have returned. After nine days of travel by train, electric interurban, bus, taxi and modus pedi, the curiosity of 21 senior chemical engineers and two members of the faculty has been satisfied and all are again home.

The occasion for the travel was the annual inspection trip of the senior chemical engineers. Approximately 25 industrial plants located in Milwaukee and vicinity, Chicago and suburbs, Joliet and LaSalle, Ill., were visited by the party. The "gang" left on Thursday evening, March 20th, and returned on Saturday, March 29th. The two faculty members of the party were Dr. C. A. Mann, chief of the division of chemical engineering, and Prof. G. H. Montillon of the same department.

Among the plants visited were: Pfister & Vogel's tannery, the Patton Paint Co., the Goodrich Linseed Oil Co., the Milwaukee Gas & Coke Co. at Milwaukee; the United States Glue Co. and the Newport Chemical Co. at Carrollville, Wis.; the Sherwin-Williams Paint Co., Swift's Packing Plant, Libby-McNeill & Libby and the Barrett Co. in Chicago; the Universal Portland Cement Co. at Buffington, Indiana; the U. S. S. Lead Refining Co., and the Grasselli Chemical Co. at East Chicago, Ind.; the Standard Oil Co. at Whiting, Ind.; the Corn Products Refining Co. at Argo, Ill.; the Illinois Steel Co. at So. Chicago; the Chicago Heights Bottle Works at Chicago Heights; the American Steel & Wire Co. and the American Refractories Co. at Joliet, Ill.; the Western Clock Co. at LaSalle, Ind.

The purpose of the trip was to acquaint those about to graduate with the methods being used in large scale production, and also to demonstrate the wide field now being conducted by chemical engineers. It did all this and much more. It can be said without a bit of exaggeration that every man on the trip now appreciates his chosen profession as never before.

Besides the purely business end of the trip, many other bits of action took place. Theaters were a great center of attraction; so were hash houses and other centers of the culinary art. Some of the married men forgot for a few days their station in life, but they deserved a well earned freedom of nine days. Valparaiso, Indiana, seemed to be quite an attractive place to one of the members of the party; he says the horses down that way are excellent riding. It is still a puzzle how F. & B., the elongated duet, managed to sleep together in one six-foot bed. The ability of a certain member of the faculty to play billiards seemed to indicate that he does not spend all of his time reading trade publications and new books on the chemical industry.

Work in this case was a pleasure. We all had a real time and returned with regret. Only Doc Mann and "Monty" could have arranged such a useful and yet joyful trip.

EVOLUTION OR REVOLUTION?

For some reason unknown to us miserable mortals, we were permitted to stand before a camera and be photographed three ways at once just four years ago when we were freshmen. Not long ago, we were again permitted to bear a trademark and be Bertilloned again. What the reason is, we poor Seniors are at a loss to know.

Is someone writing a thesis on "The Evolution of Good Looking Engineers"? If so, the chemical branch must be a wonderful disappointment and an upset of theory. We have our ostrich, our giraffe, our little runt and all the freaks; but where can you find the noble appearing gentlemen whom Shakespeare described as being "in fair round belly with good capon lined"? The thesis is likely to become the Revolution and not the Evolution of good looks.

PERSONALS

"Irwin" Lavine has decided to allow his mustache to grow longer. It may make an excellent brush for spring house cleaning.

The Pyro-Lig Brothers, Rudy and Norm, have been searching for deodorizers for a long time without success. May we suggest that sweet essence of KCN taken internally may remove all things attached to their persons, including life insurance.

We are pleased to announce that the Water Laboratory at the top of the stairs on the second floor is no longer a play room. The occupants thereof have decided to convert it into a room of more use to them, a nursery.

Mr. Cecil J. Mayo of Miles City, Montana, announces to the world that he has now completed his drill. He has willed his knowledge to Mr. Lyman H. Coult of Fairmont, Minnesota, so that that worthy gentleman may also complete the requirements unjustly made upon him by the military department.

The Senior Class wishes the Junior Class and those Seniors who will again be exposed the best of luck during the period of Junior Exams, soon to be with us again. May next September not find so many who return to school under the cloud of a reappearing examination period.

ELECTRICALS

Interest in the question "After Graduation—What?" continues at fever heat among the Seniors. Since our last issue, representatives of the following organizations have visited our department and tendered certain men offers of "positions": men from five of the various branch companies of the American Telephone and Telegraph Company were here on March 3, 4 and 5. At about the same time, both the Fort Wayne and the Schenectady plants of the General Electric Company sent us representatives. The Northern States Power Company has recently announced that they intend to start a new student engineer's course, and a number of the men have applied for places. During the spring vacation the representatives of the Western Union and the Century Electric Company were here, and a man from the Chicago Central Station Institute is due early in the spring quarter.

Chauncey L. Greene has been doing special laboratory work in connection with rehabilitating the large Tesla coil in the main laboratory. This coil is rated at 1,000,000 volts, 150,000 cycles and is de-

(Continued on page 22)

ELECTRICALS

(Continued from page 21)

signed for high frequency testing of high tension transmission line insulators. Greene has spent much time on designing and testing a new type of secondary winding for the outfit, having worked on this problem for nearly two years. He expects to have the coil in proper working condition this spring. F. C. Anderson and H. W. Dahl have also been doing special laboratory work. They have been studying the problem of corona discharge and corona losses on high tension transmission lines.

During the past month, E. A. Skinner, Assistant Director of the Research Department of the Westinghouse Company, gave the Minnesota section of the A. I. E. E. a very interesting and instructive talk on the work accomplished by that research organization and the place of a research department in a large industrial company such as Westinghouse. Shortly afterwards, R. E. Doherty of the General Electric spoke to the student branch on the problems to be met with in the transmission of power over long distances, and discussed the properties of a 500-mile line. His mathematical developments and the graphs he used to illustrate his points looked pretty enough and certainly brought to our attention quite forcibly the many things we have yet to learn.

Again do the redoubtable seniors forge ahead. This time because a goodly number of the "byes" sacrificed their spring vacations to the cause of learning and spent their time in the laboratory doing the experimental work for the spring quarter in A. C. Some of the fellows have completed the entire work.

The fixtures of the new building will approach a Utopian ideal as their asymptote if the seats to be supplied for the lecture hall are any criterion. They are deep, wide seats of the two support type—vis, neck and spine—and are the acme of comfort. The lecture hall should become a favorite place in which to grab forty winks.

The subject matter of the course offered last quarter in Advanced High Frequency Measurements, which, according to Prof. Jansky, was neither advanced nor high frequency, turned out to be of rather a unique nature. Leastwise Otto Heidelberger learned to imitate a rooster very proficiently when he was locked in the coop in the radio station. Get all the embarrassing details first hand!

MECHANICALS

AUTO ENGINE WORKS

The American Society of Steel Treating had a very interesting trip to the Auto Engine Works on Wednesday evening, April 2. This company has several different types of aeroplane engines, including a Mercedes Zeppelin motor, which are being overhauled and converted into Marine motors. Mr. Sweet of this company gave a demonstration on the selection of metals by the "spark test." These meetings are always open to students and are usually very interesting.

TYPING VS. FARMING

It is rather fortunate that the recent snow put a stop to the overzealous agriculturalists who have been practicing golf on our lawn. Miss Watts will either have to become more proficient in the art of golf or else she will have to plant a garden in the space that has been spaded up.

MR. JACOBI MARRIES

Mr. Jacobi recently became the victim of one of cupid's arrows, but he is now improving rapidly under the very competent care of Mrs. Jacobi. Of course he will never be the same "Jake." There is only one thing that we can do, so we wish them many happy and prosperous years.

TAU BETA PI FRESHMAN PRIZE

It has long been felt by certain upper classmen and members of the faculty that more should be done to foster interest in scholarship among the lower classmen and especially among the freshmen in order that they get a proper start in their college careers. As a result of this feeling, Tau Beta Pi, honorary engineering fraternity, has decided to give a prize to the man who has the highest scholarship record in the College of Engineering and Architecture, School of Chemistry, or School of Mines, for the whole of his freshman year. The winner will be announced at a freshman convocation early next fall and the prize conferred at that time. It is planned to establish this prize as an honor to be conferred each year upon the highest freshman.

Tau Beta Pi was organized in 1885 to answer a demand for an organization which would have the same relation to the technical schools that Phi Beta Kappa has to the academic schools. The local chapter was established in 1909 and is one of the strongest in the fraternity. The annual spring election of the Minnesota chapter of men from the Junior class will take place soon.

TECHNO-LOG DELEGATES GO TO AMES

Clarence W. Teal and Philip E. Richardson represented the Minnesota Techno-Log at the National Convention of the Engineering College Magazines Associated, held at Ames, Iowa, April 4 and 5. The important Technical College magazines of America have a live and efficient organization in the E. C. M. A. It is well to note that the Minnesota Techno-Log rates high in this group.

PANAMA HEALTH CONFERENCE

Dr. Belisario Porras, President of Panama, has called a conference of the maritime quarantine authorities of the countries located on the West Coast of South America to convene at Panama, February 25th to 29th inclusive, under the direction of Colonel Juan Antonio Jimenez, Secretary of Development and Public Works, for the purpose of considering and studying the maritime quarantine problems of the West Coast of South America.

The Health Departments of Ecuador, Peru and Chile, the United States Public Health Service and the Pan-American Union have been invited to send delegates. It is expected that observers from other countries will also be present. The program includes formal discussions on matters pertaining to quarantine, practical demonstrations of quarantine methods and demonstration of laboratory methods.

It is expected that the Conference will be productive of beneficial results in the improving of sanitary conditions in certain ports on the West Coast of South America and will result in increased health protection to the Panama Canal and the countries participating in or attending the conference.—United States Public Health Service.

TECHNICALITIES

NURSERY FABLES

A Jolly Birthday Party

Alice laid down her pipe and sighed wearily. It was the day of her 11th birthday, and she was frightened at the swiftness with which the years went by. She walked over to the mirror, looked at herself, and sighed, once more. Signs of her recent fight against the use of opium were still visible. Little crow's feet were etched around her eyes, serving as trenches for the elusive mascaro.

"Hell," she pouted.

Her gloom was interrupted by the entrance of little Billy, aged 6½ and the middle of the Three Twins. Billy, who had recently lost his leg in a raid at Cushman's, was his usual optimistic self.

"Hello, sis," he greeted her, affectionately punching her stomach, "when does the birthday party begin?"

"At 8," she replied. "Has Tommy got the gin?" Tommy was nearly 4, the youngest of the Three Twins, and had already served a term at Ossining.

"Yes, but it's in him," laughed Billy. "He just threw dear old Aunt Polly in the sewer."

This naturally cheered Alice, and she chortled merrily.

"The rascal," she chided. "And poor Auntie a paralytic!"

But they had to stop their gales of merriment and undress for the party. Alice slipped on her prettiest frock—the one without any waist or skirt, and Billy got into his Tuxedo. Billy was very handsome in evening clothes, his dark moustache going so well with the somber hue of his vesture. Tommy staggered in and dressed, too.

Soon the party started with all the merry young folk in constant laughter. Two girls from Wellesley, and of course the entire delegation from Princeton, passed out quickly, but the others managed to stay on their feet, and although one of the boys got a little excited and hit poor granddaddy Twin on the head with a bottle of absinthe, there really were no untoward occurrences. Toward dawn the innocent little frolic broke up, and everyone wished the charming Alice many returns of the day. And Alice, happy as a lark over the wonderful presents she had received, which consisted of a set of de Maupassant, a flask, a can of Prince Albert, a black eye, and a gram of morphine, wished that every day was a birthday.—Jester.

A peach came walking down the street;
  She was more than passing fair;
A smile, a nod, a half-closed eye,
  And the peach became a pair.
Medley.

"Did your house party girl wear your pin?"

"No, but she gave several of the boys the pins."—Banter.

I ASK YOU, DID YOU EVER?

Did you ever see a girl whose eyes were brighter than sapphires, whose hair was finer than silk, and with the advertisement, a skin you love to touch, whose form made Venus look like a washer-woman, who thrilled every nerve in your body and gave your heart St. Vitus dance, and after much indecision you tightened your tie and asked her in a husky voice to dance? And she replied with a crack of her quid, "I ain't dancin' this here one, on account o' me corns."

Did you ever?—Banter.

Farmer Brown—How's yer son Josh makin' out at collidge?

Neighbor Green — Tolerable well, thank ye. Reckon he must be workin' in some furrin exchange bank or other in his spare time.

Farmer Brown—Thet so?

Neighbor Green—Yes, he writ hum he was puttin' in a lot o' time at the Pole Vault.—Punch Bowl.

OH, MOTHER, DON'T HURRY ME!

Mother—Are you entertaining a young man tonight?

Daughter—No, mother, I just met him today.—Sun Dial.

MANY A TRUE WORD, ETC.

"Papa, what is a low-brow?"

"A low-brow, my son, is a person who likes the funny papers, snappy stories, girl shows and the like and don't mind saying so."

"And what's a high-brow, papa?"

"A high-brow, my son, is a low-brow who won't admit it."—Sun Dodger.

Bobb—Fluffy's very fond of the up-to-date story. Did she tell you any to speak of?

Hare—No, not to speak of.—Punch Bowl.

SO DO WE ALL

The following advertisement was seen recently in a magazine:

Baily, Banks and Biddle Company
Watches for Women
of
Superior Design
and
Perfection of Movement
—Jack o' Lantern.

The Page—You are in very good spirits, sire.

The Knight—Last night my lady allowed me to see her incognito.

The Page—Oh sire, is there aught that you have not seen?—Lemon Punch.

Rose—Did Reggie blush when his track suit split up the side?

Mary—Why, I wasn't noticing.—Purple Cow.

NOT KNOTT WATT

Two guys on a telephone:

"Are you there?"

"Who are you, please?"

"Watt!"

"What is your name?"

"Watt's my name."

"Yes, what's your name?"

"My name is John—John Watt."

"John Watt?"

"Yes."

"I'll be around to see you this afternoon."

"All right. Are you Jones?"

"No, I'm Knott."

"Will you tell me your name then?"

"Will Knott."

"Why not?"

"Not what?"

"No, Knott Watt. William Knott!"

"Oh, I beg your pardon!"

"Will you be home this afternoon?"

"Certainly, Knott."

"What?"

"Yes—"

"Aw, shut up!"

NO PULL, EITHER

A wealthy motorist, while touring through Georgia, drove up to a gasoline station and found the tender a lazy country boy.

"Hey, boy," said the motorist, "I want some gasoline. Get a move on you. You'll never get anywhere in this world unless you push. Push is essential. When I was young I pushed and that got me where I am."

"Well, boss," said the boy, "I reckon as how you'll have to push again, 'cause we ain't got a drop of gas in the place."—Columns.

She was a freshman from Vassar. "Oh, dear," she sighed, "I simply can't adjust my curriculum."

"It doesn't show any," he reassured her, blushing. And then they both talked rapidly about the decorations.—Jester.

"Have you seen Ethel lately?"

"No, I quit going out there because she made suggestive remarks."

"What?"

"Yes, she was always suggesting shows and things we could go to."—Cracker.

Let us all now rise and sing our latest song hit: "Mister Judge, please forget your grammar, and leave the period off my sentence."—Cracker.

Mother (to caller)—What do you think of my daughter?

Gentleman Caller—I am sorry, but I am no judge of paintings.—Puppet.

She—Who is that man wearing a black robe? Is he a chimney sweep?

He—Naw, he's a Ku Klux Klansman from Pittsburgh.—Malteaser.

THE ELECTRICAL BUILDING

By Albert W. Morse, E. E. '25

"At 9:10 on the morning of May first," is the answer the contractors give to all queries asking when the new electrical engineering building will be completed. "Yes, sir, you can move in at 9:10," the superintendent of construction adds with emphasis.

This means that the electrical building will be finished on time, something quite unusual on the campus. The million-and-a-half dollar library of the University is dragging along behind time, and even the new shops were late. It means that the electrical department will be fairly well settled in its new quarters before the summer is over, and it means, also, that the contractor will not have to forfeit fifteen dollars for each working day that the job requires in addition to the allotted time.

It is not difficult to understand the feelings of the students when they learn that their building is nearly completed. The anticipation shown last spring when the steam shovels broke the first ground has developed into a genuine feeling of ownership, and as the work has progressed the excursions taken through the new structure have increased in number and thoroughness. From the men who will be seniors next year down to the mere freshmen, this attitude of intense interest has been shown. In this respect it is worthy of note that an overwhelmingly large percentage of the freshmen have indicated their intention of taking up electrical engineering. At a recent class in orientation, held each week for the first year men, the annual practice of having the men announce their choice of professions was carried out, and about seventy-five per cent put down "E. E."

On the first of April, a general checking-up of work completed showed that the building has passed the stage of rough construction. Hardwood floors cover the bald unsightliness of the concrete and lend a more habitable aspect to the rooms. All interior trim, including door casings and jambs, has been applied; interior doors have been hung.

Floors are down throughout the building; cement in the basement corridors, machine rooms and storage battery rooms; and terrazzo (composition) in the corridors on the first, second and third floors. They are ready to be treated with a chemical hardener, Granolithic.

The walls, floors and radiators in the storage battery room will be treated with asphaltum to protect them from the acids and gases from batteries.

In the main laboratory, there will be a shoulder-high wainscoting, and above this there is to be green paint of various shades on the steel and walls to give light refraction and reduce the "apparent" amount of steel present, reducing the otherwise bulky appearance. The steel wall trenches, bench brackets, race-ways, stairs and handrails in the laboratory will be treated in a similar manner for the same purpose.

The wall benches themselves are supported by heavy, steel, angle brackets anchored into the walls so they can take heavy loads such as motors and allied machinery; and the surface is covered with battleship linoleum.

The main crane is of four tons capacity, run by a direct current motor, and the 150 K. V. A. set, which furnishes the current for this apparatus, is now in place in the machine room.

In addition to the two main switchboards located

(Continued on page 28)

PROGRESS ON THE E. E. BUILDING

(Continued from page 26)

in the main laboratory, there will be from one to 24 boards in each of the other rooms of the building so that various types of service can be had.

The Kasota marble wainscoting and partitions for the toilets and janitor's closets has been put into place.

A push-button controlled elevator is being installed on the north side of the laboratory. It is going to be run by an A. C. motor, will be of the basement traction type machine, and is to have all of the modern safety devices.

The terraced floor in the third floor, main lecture hall is finished, and light-proof window shade cases of heavy, furniture steel are in place.

The engineers have full power to inspect all materials used in the building, either during construction, before installation, or after they are built into the structure, and errors or defects discovered before final acceptance of the work must be corrected by the contractor, regardless of previous inspections.

The new electrical engineering building has every appearance of being one which is well constructed, will be finished on time, and will give the department housing quarters of the highest quality.

SAINT PATRICK IS WITH US AGAIN

(Continued from page 5)

mates. Saint Patrick's Day affords him the opportunity of meeting not only those who have the same interests at heart but also those who have other interests in life. This is one of the most valuable assets to one who must in later life meet men engaged in other occupations, and who must thoroughly understand the problems which confront the men of the engineering profession.

"It is therefore desirable that every engineering student enters into the activities of this day, not only for his own advancement but also for the advancement of his profession, which he can bring about by thoroughly acquainting the public with the means at hand for his training."

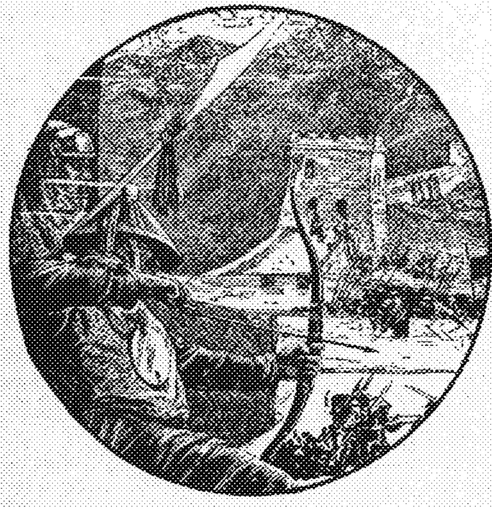
RECOGNITION OF ENGINEERING GENIUS

(Continued from page 9)

mony of line and its crystal white marble columns, contrasting so wonderfully with the green shrubbery which seemed to fondly enwrap its base. Mounting its wide steps, leading solemnly to the great platform supporting the massive fluted columns, I passed into the silent chamber where straight before me rested a massive statue of Lincoln. It was a statue of passive beauty, for there is always beauty in strength, and character portrays a strength more immortal than that of the flesh. Some indescribable emotion sweeps the soul in this chamber and grips old and young with varying intensity. It must be the feeling of satisfaction or of just reward for one who suffered so in life, that moves us in this hall of memory to an overwhelming gratitude to this "Man of the Ages."

Upon the left was Lincoln's Gettysburg Address, and upon the right Lincoln's second inaugural address carved deep into the marble walls in immense letters, and by reading them there in these surround-

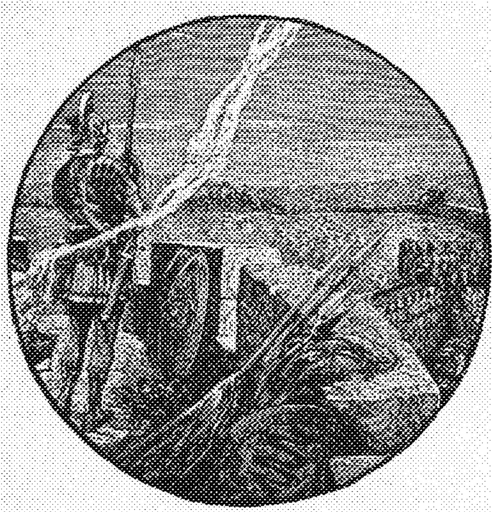
(Continued on page 32)



Do You Know

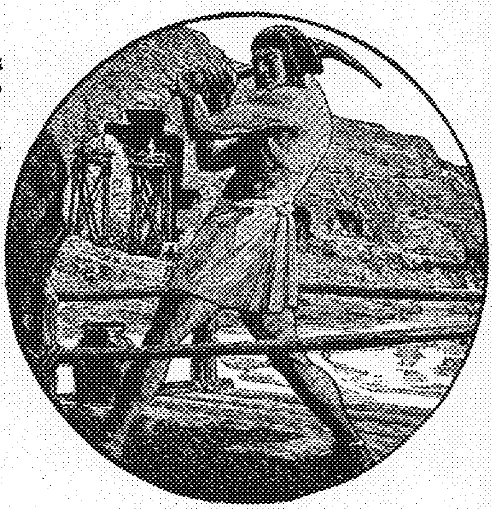
—who were the Copper Miners of the Stone Age?

—that the Great Wall of China is long enough for the earth to spin on it as an axis?



—that Coal Burning was once a crime in London?

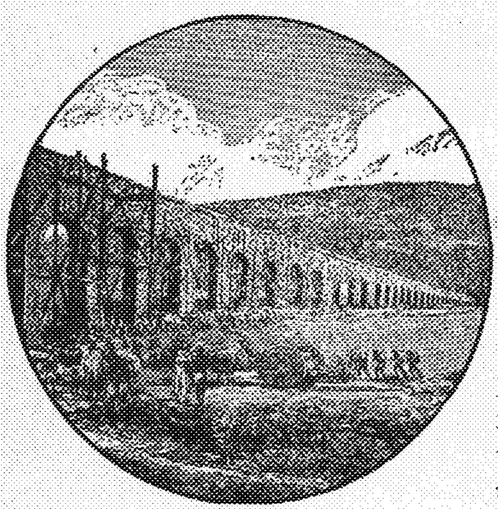
—what great monarch was called "the Builder" a thousand years before the birth of Christ, and constructed the temple of "Snow and Gold"?



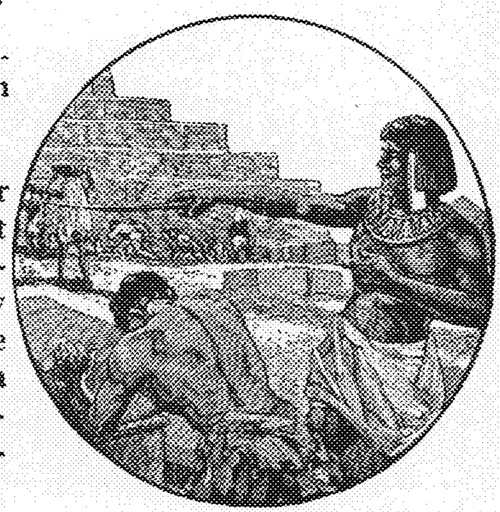
—who owned the "Silver Ships of Tarshish"?

—what great aqueduct ranks foremost among the engineering feats of the Roman Tunnel Builders?

—who made the most productive fishing trip in history?



These, and many other interesting facts about the difficulties encountered and overcome by the great builders of the past, are contained in a new and unusually attractive 62-page illustrated book entitled:



"Conquering the Earth"

Write to the Hercules Powder Company's advertising department, 941 King Street, Wilmington, Delaware, for a free copy of this book, which you will want to place in your library at home.

WORK ON STADIUM PROGRESSES

By Leonard Kleinfeld, M. E., '26

In spite of the fact that the recent snowstorm hindered operations somewhat, work on the stadium is progressing rapidly.

The S. J. Groves Construction Co., in charge of the excavation, has two steam shovels at work. The material removed is being used to fill in the abandoned Northern Pacific cut, two small locomotives hauling six trucks each, being employed to transport the soil to the west end.

The sand and gravel bins and the pouring tower are almost complete. Meanwhile a small concrete mixer is being used on the footings for the towers and the north side; this portion of the work is almost finished.

The forms for the decks, risers and beams on the north side are now being built, and pouring will begin with the completion of the necessary plant.

Two Minnesota graduates are on the job: E. F. Cummings, C. E. '13, is the engineer in charge of construction, and assisting him is George Schaller, C. E. '23, who is also timekeeper and in charge of material.

ARABS WILL PRESENT "RIQUIQUI"

(Continued from page 10)

leading role this year in "Riquiqui." Among the members of the club today there are several men who worked to produce "The Caliph of Colynos" when the Arabs were unknown and inexperienced. These men have seen the club grow and expand into the most popular and ambitious dramatic organization on the University campus.

AN ALUMNUS PASSES ON

(Continued from page 16)

Committee of the United States Chamber of Commerce in Washington—working on a two and one-half million dollar project. When I complete this, it will probably close my technical career of 47 years."

In the hurry and bustle of life, our alumni are scattered all over the country. Different activities and different lines of work seem, at times, to divert attention from the University. When one of our graduates passes on, however, the thought is brought out most forcibly that it is fitting that we stop a moment in respect to the men like Mr. Gillette, who, by their accurate thinking and hard work, are making the words "A Minnesota Engineer" an honorable title, indeed.

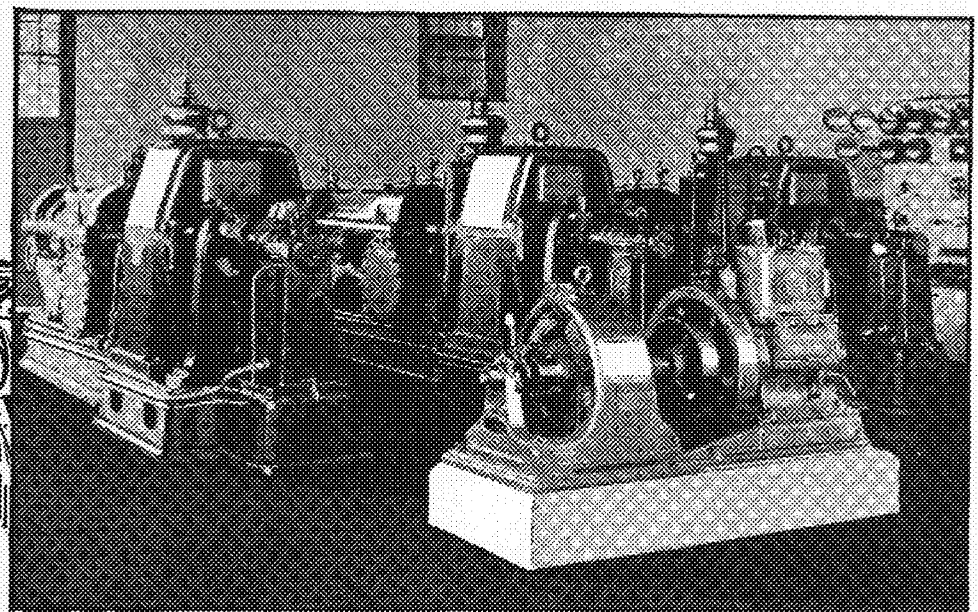
THE PITTSBURGH TESTS

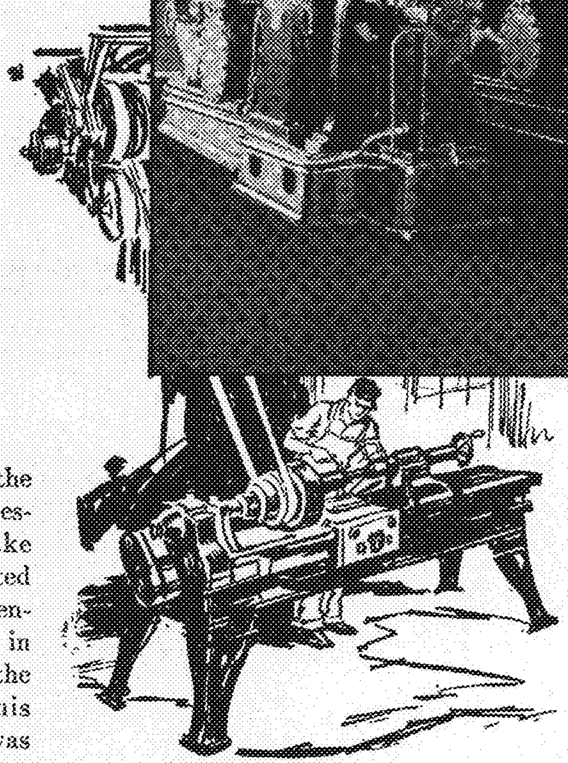
(Continued from page 13)

will be found that it will be practically consumed in four to five hours. If, on the other hand, that same piece of steel contained 2% copper or thereabouts the loss by the action of the acid is materially reduced. The explanation of this phenomenon is that when the copper bearing sample is immersed, the steel being soluble dissolves quite rapidly liberating the copper which is quite insoluble. The copper then plates itself upon the steel providing it with an impervious coating. This explanation might be offered for the behavior of the sheets exposed at Pittsburgh. It is estimated that there are 4,000 tons of coal dust per square mile precipitated annually in Pittsburgh. The city is located at the junction

The Great Engineering Achievement of 1899

What Engineering Owes to Initiative





Daddy of All Large Commercial Turbines Began Operation at Wilmerding

PRIOR to 1899 the works of the Westinghouse Airbrake Company was operated by reciprocating engines distributed in various parts of the plant. While this source of power was inefficient in many respects, it was the best known commercial motive force of the day.

By 1899, however, remarkable developments had been made in the design and construction of steam turbines and electric generating equipment. Called to the attention of the Airbrake officials, it was decided to give the new machines a chance, and three Westinghouse Steam Turbines were installed without delay. This was the first large installation of its kind, anywhere.

It required *initiative* to take this step—someone had to be first. And, as in all important pioneering achievements, there was much skepticism as to results. However, the new units quickly proved their practicability. Although of only 400 K. W. capacity they proved much more efficient and economical than the old reciprocating engines. Their economy was particularly conspicuous because by careful test they showed a fuel saving of approximately 36 per cent.

Steam turbine development thus received its first real impetus in 1899, the Wilmerding, Pa., performance definitely establishing this electrical unit as a *better* method of turning the wheels of industry.

Westinghouse

WESTINGHOUSE ELECTRIC

ACHIEVEMENT & OPPORTUNITY

of two rivers and is built upon a low marshy location, the resulting humid atmosphere, being charged with sulphur from the smoke, very naturally produces sulphuric acid. This substance coming in contact with the ungalvanized thin gauge sheets would naturally attack them quite readily. In the case of the copper bearing sheets, the copper undoubtedly was liberated and, since there was no disturbance to prevent the plating process, the copper plated itself upon the sheets and afforded them protection. In the immersion tests the same action was started but since the water was in continuous movement this plating process could not be carried on and hence the failure of the copper-bearing samples.

Practically the only conclusion that could be drawn from the Pittsburgh Test is that no accurate deductions could be made at all and the society itself has drawn no deductions. Duplication of actual service conditions is absolutely necessary in order to draw accurate conclusions and, since laboratory methods were employed to a large extent in the carrying on of this test, little of practical information results.

RECOGNITION OF ENGINEERING GENIUS

(Continued from page 28)

ings, they were carved into the heart of my memory for all time.

Far away across the mirrored pool, across the rising sward, looms the imperishable shaft of Washington, its pyramidal top seemingly touching the low flying clouds. From its tiny outlook five hundred feet above its base, no doubt other pilgrims gaze upon the monument to Lincoln, but they doubtless have not stood in the great chamber where gratitude is crystallized, and from its portals looked upon the towering symbol erected to the FATHER OF OUR COUNTRY.

How fitting these memorials! How just the reward! And yet each year thousands upon thousands make their pilgrimage to these two masterpieces of engineering and architecture, totally ignorant of the master minds who conceived and reared these edifices that shape the character of every beholder of their silent majesty.

COMPARATIVE STRENGTH OF WALLS

(Continued from page 8)

the spray was to loosen up some of the surface fibres due probably to the erosive action of the water.

All of the absorption tests were much more severe than would ordinarily be met in practice, but were made to determine the possibility of the material breaking down under extraordinary conditions. While celotex was the only substitute material compared with wood sheathing, there are others on the market which would no doubt give satisfactory results when so used.

Another point which is not brought out in these tests is the insulating properties of the celotex which are very superior to ordinary one-inch wood sheathing.

THE PSYCHOLOGY OF ADVERTISING

(Continued from page 6)

interesting, he is bound to read it. If he realizes that a firm is interested enough in him to compile an authoritative, sincere and convincing advertisement just for him, he naturally stops and thinks of his connection with their business.

Easy comfortable English style has the call this season

THEY are styles beautifully adaptable to the fastidious tastes of young men. And we've varied our models with this in mind; that young men want both individuality and correct style. Our suits offer both at

$50

others $35 $45 $55 $65

Maurice L Rothschild & Co

Palace Clothing House

Nicollet at 4th

Money cheerfully refunded

Minneapolis
St. Paul
Chicago

EDMUND HALLEY
1656-1742
Son of a London soap-boiler who became Astronomer-Royal. At the age of 20 headed an expedition to chart the stars of the Southern hemisphere. Financed and handled the printing of Newton's immortal *Principia*.

The comet came back

The great comet that was seen by William of Normandy returned to our skies in 1910 on its eleventh visit since the Conquest. Astronomers knew when it would appear, and the exact spot in the sky where it would first be visible.

Edmund Halley's mathematical calculation of the great orbit of this 76-year visitor—his scientific proof that comets are part of our solar system—was a brilliant application of the then unpublished *Principia* of his friend Sir Isaac Newton.

The laws of motion that Newton and Halley proved to govern the movements of a comet are used by scientists in the Research Laboratories of the General Electric Company to determine the orbit of electrons in vacuum tubes.

As spectacular as a comet has been the world's electrical development. By continuous scientific research the General Electric Company has accelerated this development and has become a leader in the industry.

GENERAL ELECTRIC

MINNESOTA TECHNO-LOG

VOL. IV. NO. 7 MAY 1924

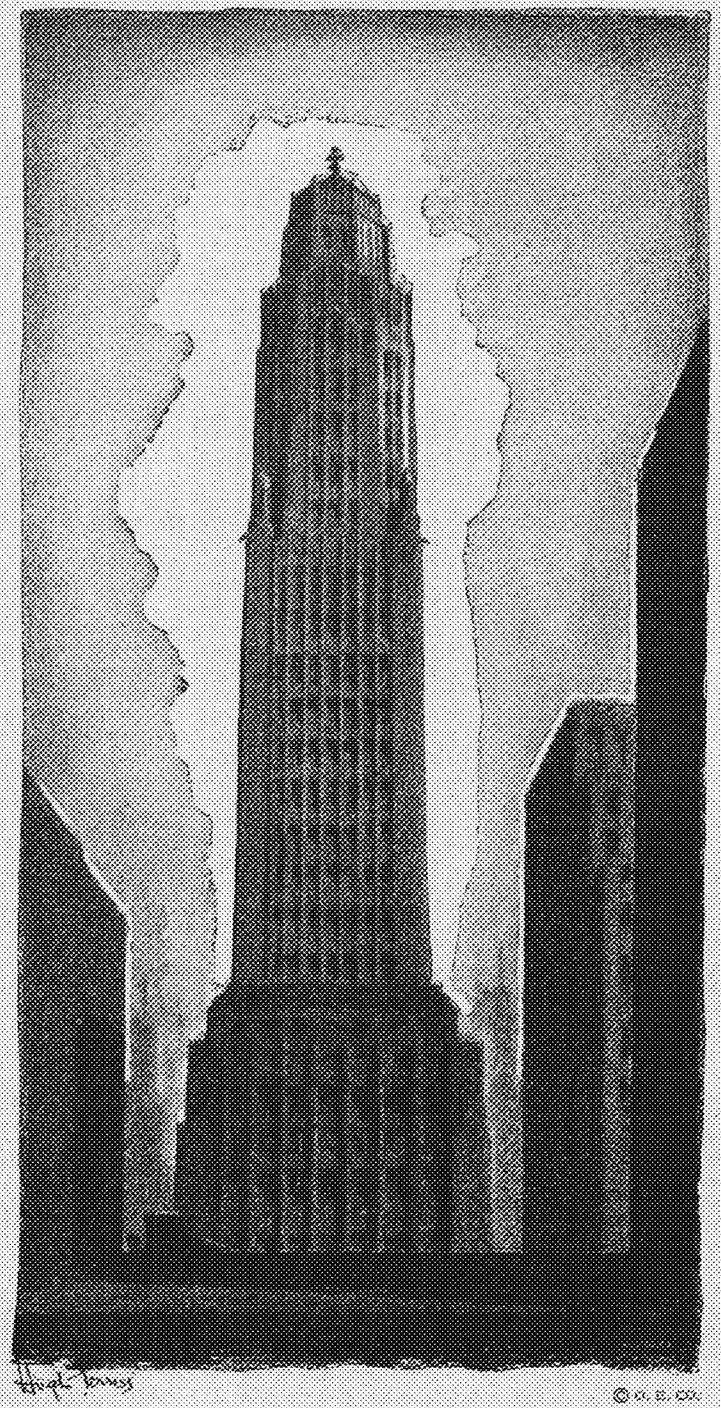
Published Monthly During the School Year
by the Students of the College of Engineering
and Architecture, School of Chemistry
and School of Mines of
the University of
Minnesota

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

The Bush Building
New York City

HELMLE & CORBETT,
Architects

Drawn by Hugh Ferriss



© O. E. CO.

"A Noble Profile"

FAR more strongly than most churches, this great tower of commerce bespeaks the real spirit of Gothic architecture—aspiring, rugged, virile—an inspiration for the thinking, creating architect of today. Contradicting the antiquarian, this great tower declares that the spirit of Gothic architecture is a living, organic thing, adaptable to modern problems of accommodation and engineering, and endowed with a future as magnificent as its past.

Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

O T I S   E L E V A T O R   C O M P A N Y

Offices in all Principal Cities of the World

INDEX TO ADVERTISERS

MINNESOTA TECHNO-LOG

Published and Copyrighted Monthly by

The Engineering Students
of the
University of Minnesota

Main Engineering Building, Minneapolis, Minn.

Subscription $1.50 per year | Twenty-five Cents the Copy

VOLUME IV | MAY, 1924 | NUMBER 7

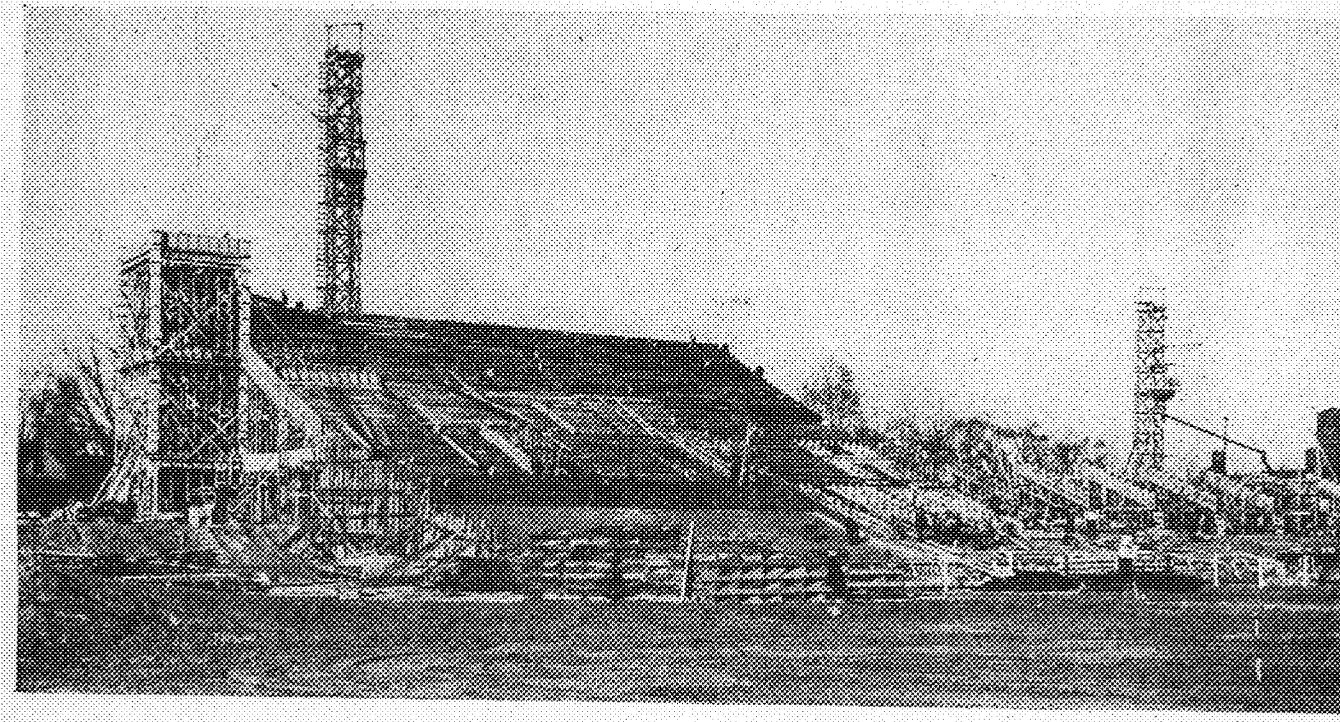
TABLE OF CONTENTS

MEMBERS OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

Chairman: Prof. Edwin Kurtz, Iowa State College, Ames, Iowa

The Cornell Civil Engineer
The Transit
Iowa Engineer
Colorado Engineer
Nebraska Blue Print
Penn State Engineer
Armour Engineer
Sibley Journal of Engineering
Rose Technic
Michigan Technic
Minnesota Techno-Log
Virginia Journal of Engineering
Ohio State Engineer
The Towne Scientific Journal
Wisconsin Engineer
Illinois Technograph
Tech. Engineering News
Kansas State Engineer
Princeton E. A. News Letter
Kansas Engineer
Purdue Engineering Review

MINNESOTA TECHNO-LOG
University of Minnesota
VOLUME IV MAY, 1924 NUMBER 7



The North Stands on May 3

THE STADIUM GOES UP ON SCHEDULE

Homecoming Game Will Open New Field Next Fall--- Seats Will Be of Wood

By L. A. Tvedt, Arch. '25

(The author wishes to thank Professor F. M. Mann and members of his staff, and Professor Otto S. Zelner and members of the civil engineering department for their assistance in the preparation of this article.)

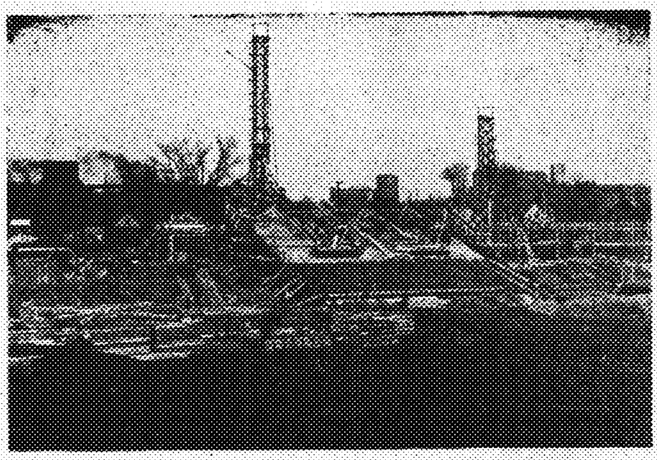
DURING the last few weeks the students have had the privilege of seeing the beginning of a project which, when completed, will mark an epoch in the athletic and building program history of the University. We have been able to see the work actually started on Minnesota's new Memorial Stadium. The project, which has been the dream and hope of all who have been connected with it, is now a reality, and before Homecoming next fall we will have a stadium second to none. In it we will find embodied many features of the country's best stadiums, and those under whose direction the work has been planned and is now being carried out say that it will be one of the best of its kind among college and university stadiums in the United States.

Professor F. M. Mann, head of the architectural department here at the University, has been in charge of the design of the stadium. At the time of the conception of the idea, it was decided that Minnesota's stadium must have architectural features that would make it harmonize with the buildings on the newer campus; that it would be more than a pure utilitarian structure. The design decided upon was a "U" shaped one, with a single deck of seats, for which there is much to be said in commendation.

In general there are two types of stadiums from which to choose. There is the bowl type and the "U" or horseshoe type. The Yale bowl is a good example of the latter type, and while this style has certain advantages, it has disadvantages that made it more practical to select the open end plan for the Minnesota structure. Here the stadium and the enclosed field have to take care of other sports besides football. Now with a bowl it is almost impossible to get the quarter-mile track and the 220-yard straightaway laid out correctly and to the best advantage. Another problem to be taken care of in the design of a bowl is that of ventilation. It has been found that the air in the center and over the playing field is little affected by winds and breezes, and soon becomes stale and anything but conducive to the comfort and best efforts of the players. So after due consideration it was decided to make a stadium with an open end and the track extending out past it.

The outside walls of the stadium will be faced with brick and trimmed with stone. These walls will extend approximately fifty-seven feet above the outside grade line. It is of interest to note how the wall height, which is approximately the same as the cornice heights of the new campus buildings, has been kept so low. The playing field has been placed seven feet below the outside grade line. This means that the lower tiers of seats are below the grade line and that the ramps and portals come out at a point higher up in the seats than would otherwise have been possible without increasing the slope of the ramps. The composition of the exterior consists of three parts or bands. The lower part contains the arched openings leading to the ramps; the second is a plain band of brick; and the third or top band consists of grouped windows centered over the entrance arches. The whole composes very nicely and will give an exterior that will help make the stadium a credit to the University.

The circulation and means of going in and out of the stadium have been carefully studied and the resulting plan and arrangement is one of the best that could be obtained. There are thirty-seven arched entrances that open onto a twenty-foot concourse



April 29, 1924

that goes completely around the structure just within the walls. From this concourse there are thirty ramps that lead to as many portals opening out among the seats. The portals are about a third of the way up in the tiers of seats and are accessible from every part of the seating area. The ramps are slightly inclined, having a 16 per cent slope, and do away entirely with the use of stairs. This all helps to speed up the movement of the crowd as they can move more rapidly when no stairs are present. With one opening for every 1,500 people, the stands can be emptied in a very short time.

The stadium is to be constructed entirely of reinforced concrete and brick, no structural steel members being used at all. The structural part consists of a concrete skeleton with the slabs, in the main, resting on the columns and beams. A few of the seat slabs at the bottom rest directly on the dirt. All footings are of the stepped type and are made without reinforcement. As stated previously, the entire exterior will be of brick.

Everyone Will Have Clear View

The relative height of the seating steps as compared to the tread is not constant, and called for much study before the desired result could be obtained. The tread of the seat steps is two feet two inches, which is the same as that of the Illinois stadium. The rise varies from six inches at the bottom tier to thirteen inches at the top tier. This gives a dished cross section which permits everyone, no matter where they are seated, to get a clear view of every portion of the field. The exact method of determining the relation of rise to tread is very interesting and is discussed at length in the March, 1923, Buildings issue of "Engineering and Contracting." The treads slope half an inch in order to give the proper drainage. The tread slabs are three and a half inches thick, reinforced with wire mesh.

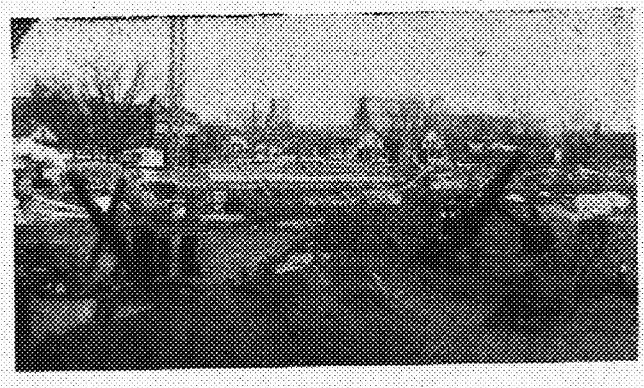
Special care is being taken in the concrete work because the quality of the concrete will be an important factor in the appearance and durability of the structure. Perhaps this is more true of stadium work than almost any other type of structure because of the large areas of thin sections.

The space under the seats will be used for locker, training rooms, etc., part of which are now being constructed. In the basement of the northwest corner we have the varsity training quarters which are made up of an equipment room, coaches' and managers' rooms, shower and locker rooms, and a training room. These quarters are connected to the dugout on the north sidelines by an incline and tunnel which permits direct movement from the quarters to the field. In the basement of the southwest corner we find similar quarters for the visiting team. In the second floors of the two wings are placed the locker, equipment, office and training rooms for the freshmen squad and for the track teams. That part that is now being completed will give the athletic department much more room than they have at the present time, and as only a small part of the second floor space is being finished at the present time, there is much more that can be finished off should the needs of the athletic department demand it.

Provision Made for Amplifier System

The seats themselves will be of wood supported on steel brackets placed in the concrete when it is poured. In addition to providing for the comfort of the players and spectators, many other little things have been taken into consideration, all of which help to make the Minnesota stadium complete to the minutest detail. Provision is being made to take care of an amplifier system which may be installed in the near future and which will enable speakers to be heard by the entire crowd. There are two covered press boxes, one on either side of the stadium, and these are very completely equipped with telephone and telegraph connections. The north press box has, in addition, a broadcasting booth.

Another task connected with the construction of the stadium was the preparation of the playing field. The general contractors were required to excavate



April 3, 1924

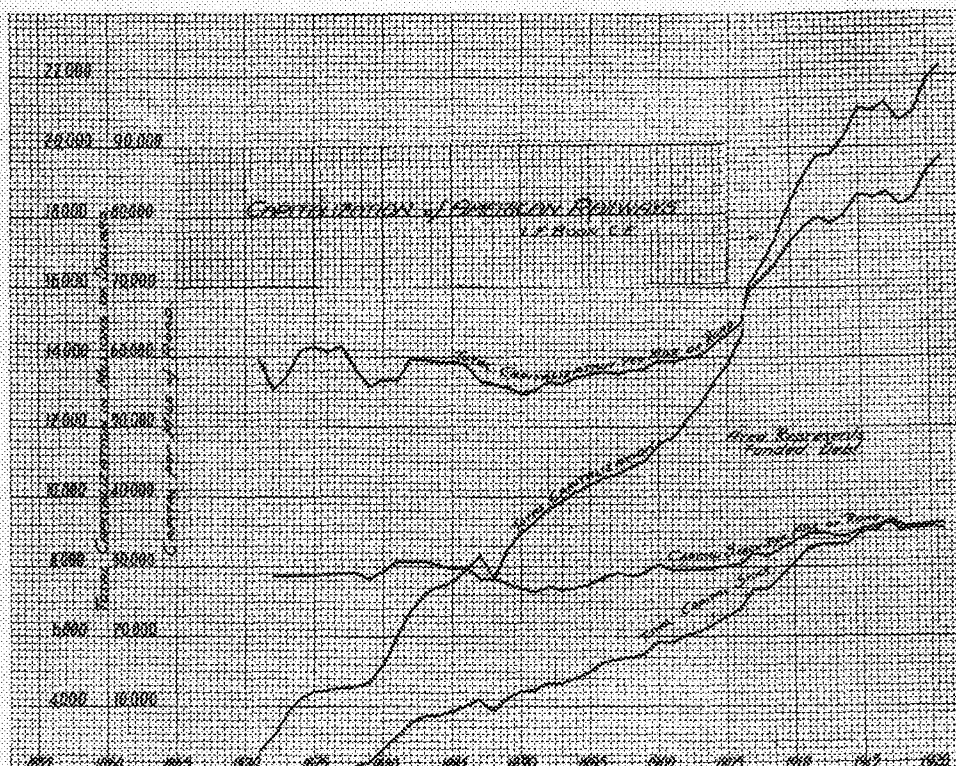
the playing field area to a level about one foot below the finished field level. The task of designing the upper surface of the field was then turned over to a special playing field committee made up of Fred W. Luehring, A. J. Lobb and Otto S. Zelner. As no two fields are exactly alike, it was necessary to

(Continued on Page 32)

RAILROADS ARE OVER-CAPITALIZED

Too Much Capital Is Obtained from Bond Issues and Not Enough from Sale of Stock

By Leonard F. Boon, C. E.



THE question of the capitalization of our American railways is of great importance. Many people think that the railway companies are over-capitalized and that freight rates are held at a high level in order to pay interest and dividends on this excess capital. While this is a question of general interest, few people have access to the data that show the money that has been invested in the railway companies.

It would be interesting to make a study of each individual company, but that is impossible in a short article; so the present study will be confined to the total capitalization of all the railroads in the United States.

Capital is made up of two elements — stock and bonds — the stockholders are the proprietors and have borrowed additional money from the bondholders. The sum of these items—stocks and bonds—is the amount on which interest and dividends must be paid. For a sound financial structure there should be some definite relationship between the stock and bonds outstanding. The relationship generally accepted is that the capital stock should be not less than fifty per cent of the total.

The figures show that up to about 1890 the capital stock outstanding was greater than the funded debt (bonds); but since that time the funded debt has increased at a slightly greater rate than has the stock. After 1900 the rate of increase for the funded debt has become noticeably greater. In 1921 the stock made up 40.7 per cent and the funded debt 59.3 per cent of the total. The reasons for the changes of the relative ratios of these forms of capitalization are many; the principal one probably is the declining rate of return on stock and the more certain return on bonds.

Although the total capitalization of our railway system is an important item in the financial world, it is more or less meaningless unless we know how much mileage of line or track is represented; therefore, curves showing stocks and capitalization per mile of line are given.

Too Much Capital Obtained from Bond Issues

Note, first of all, that while the capital stock per mile of line has been fairly constant throughout the period, there has been a large increase in total capitalization, largely represented by an increase in the funded debt. The capital stock averaged $26,428 per mile in 1891 and $36,133 per mile in 1921, an increase of nearly $10,000 per mile in thirty years. In the same period the funded debt changed from $28,742 per mile in 1891 to $52,616 in 1921, or an increase of nearly $24,000 per mile. It will be noticed that in 1891 the capital stock formed 47.9 per cent of the total capitalization while in 1921 it had decreased to 40.7 per cent of the total. This clearly shows that too large a part of our capital for railway expansion has been obtained from bond issues and not enough from the sale of stock.

It will also be noticed that the larger part of the increase in capitalization has taken place since about 1905. The mileage figures used in calculating the averages are miles of line (or miles of road). A mile of line may represent single track or several tracks (in a few cases there are six parallel main line tracks). Again these mileage figures represent the distances along the line between stations and do not make an allowance for the mileage of track in yards and terminals. It will be seen that a large increase in track mileage may occur without any increase in line mileage, and when we remember how much additional trackage has been built in the past ten or fifteen years, the increase in total capitalization per mile of line is neither surprising or unwarranted. In fact we will probably see a continued increase in this item for many years to come as more double and multiple tracks are built, yards are extended, heavier rail laid, block signals and automatic train control added, and other items for increased facilities or safety installed.

It would be instructive to see the corresponding curves per mile of track but they have not been

(Continued on Page 28)

MINING ALUMNI ACHEIVE SUCCESS

Hard Work and a Willingness to Travel Account for Rapid Rise In Engineering Field

By James Sutherland, C. E. '27

SINCE its organization under Dean W. R. Appleby in 1891, the School of Mines has graduated about 380 students. These men have gone into various kinds of work; many have continued in mining work, while many have gone into other types of engineering. Very few have forsaken the engineering field altogether. These alumni are scattered all over the world today, from India to England, from Mexico to Africa, but they are all successful in their chosen line of work.

Certain men, however, stand out in the annals of the School of Mines as having been notably successful in their engineering careers. A list of a few of these men with their records follows:

Graduating in 1898 with degrees of Bachelor of Science and Mining Engineer, Cyril Brackenbury was employed as a mining engineer for several years in the iron and copper mines in and about Minnesota. From 1902 to 1903 he worked for the Tharsis Sulphur and Copper Company, examining mines in Russia, Bulgaria, Serbia, and Italy. Following this, he worked in England with several well-known mining companies. In 1913 he went to Canada, being in charge of exploration work in Canada for the Mord Nickel Co. The following year he returned to England, and at the outbreak of the World War enlisted in the English army. He was made first lieutenant of the Seventh Battalion, York and Lancaster, in February, 1915. He served at the front with a tunneling company of the Royal Engineers. In July of 1915 he was seriously wounded while serving at the Somme front. Incapacitated for further active service, Brackenbury became an instructor in engineering, training other men to carry on his work. At the close of the war he was offered the position of manager of the Devon & Courtenay Clay Co., Newton Abbot, Devonshire, England, which position he has held to date.

"Doc" Is Chief with Anaconda

Wallace N. Tanner, better known as "Doc" Tanner, graduated from the School of Mines in 1896 with the degree of Mining Engineer. Following his graduation, "Doc" went to Butte, Mont., where he was employed with the Montana Ore Purchasing Co. He worked for a time in Montana, finally going to Chicago as chief draftsman with the Allis-Chalmers Co. He later became an engineer in the mining department of the same company. He again went west, becoming a member of the firm of Armstrong & Tanner, Salt Lake City, Utah. He served for a time as manager of the E. S. T. Concrete Block Co. of St. Paul, then became affiliated with the Anaconda Mining Co., first as superintendent of the foundry department, then as chief engineer of the reduction department, and later as chief mechanical engineer. At present he is chief engineer with that company and is located at Butte, Mont.

Samuel W. Cohen was graduated in 1903 with the degree of Mining Engineer. For a short time he worked as an assayer and chemist with the Consolidated Gold Mines & Development Co. at Mancos, Colo. In 1905 he became superintendent of the Gilt Edge Mining Co., Florence, Idaho. He then moved to Spokane, Wash., as mining engineer. In May, 1906, he went to Canada as superintendent of the Kerr Lake Mining Co. In 1907 he became general manager of the Crown Reserve Mining Co., Ltd., and the Porcupine Crown Mines, Ltd., where he stayed till 1918. In 1918 he returned to the United States as vice president and general manager of the Bluestone Mining & Smelting Co., Mason, Nev. Moving once more to Canada, he became vice president and general manager of the Jacobs Asbestos Co. of Thetford, Ltd., and the Federal Asbestos Co. of Robertsonville, Quebec. He served for a short time as general manager of the Croesus Gold Mines, Ltd., and consulting engineer for the Dominion Reduction Co. In 1920 he became consulting mining engineer, president and general manager of the General Asbestos Co., Ltd., of Montreal, Canada.

Some More Work and Travel

Amos F. Keene received the degree of Mining Engineer in 1904. Following his graduation he obtained a position with the Turnagain Gold Mining Co., first as examining engineer at Minneapolis, later as mine superintendent at Cableville, Ore. Soon after, he moved to Peru as superintendent of construction and acting superintendent of the Peruvian Smelting & Refining Co., Rio Blanco, Peru. In 1907 he became examining engineer for F. Kleptko, Peru. From there he went to New York City as mining engineer with A. C. Beatty and H. C. Hoover, New York and London. From New York he moved to London as consulting engineer for the Consolidated Mines Selection, Ltd. He next served on the technical committee for the board of directors of the Messina (Transvaal) Development Corp., Ltd.; Burma Corp., Ltd.; Mawchi Mines, Ltd., and Central American Mines, Ltd. He served for a time on the foreign ore reserve summary for the Colonel House Commission in the offices of the United States Geological Survey, Department of Interior, at Washington, D. C. At present he is consulting engineer and member of the New York advisory committee for the Goldfields American Development Co., Ltd.; director of the Sierra Pacific Electric Co., South American Gold Platinum Corp., Dolores Esperanza Corps., New Northwest Corp., Ltd., and American Trona Corp. and Johnson, Matthey & Co., Inc.

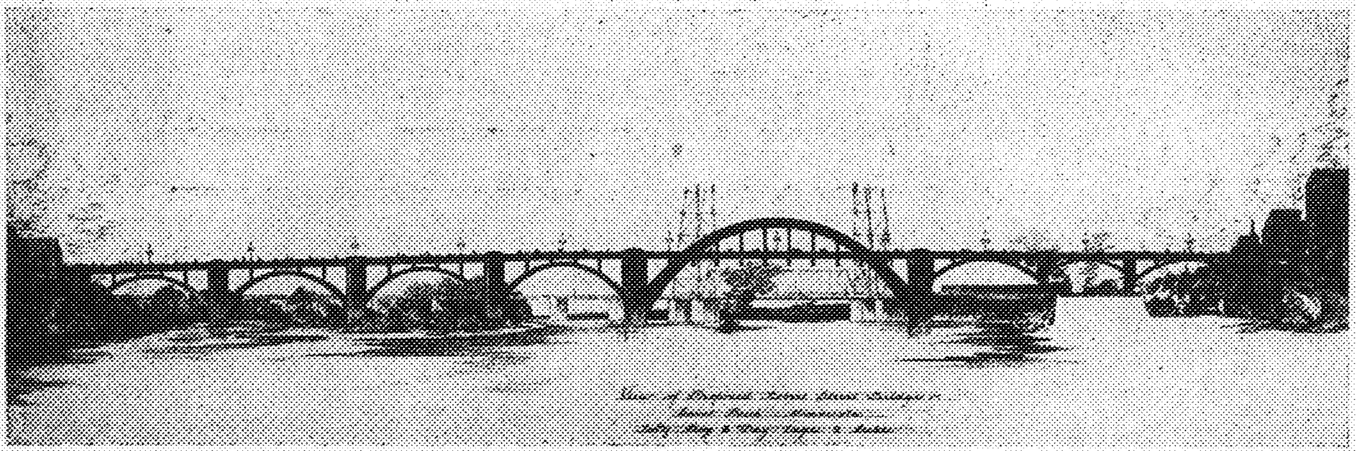
On receiving his degree as Mining Engineer in 1909, Samuel L. Hoyt went to Columbia University for two years, working for a degree of Doctor of Philosophy. From 1911 to 1913 he did further graduate work at Technische Hochschule, Charlottenburg, returning in 1914 to get his Ph.D. at Columbia. In 1915 he was made assistant professor of metallography at the school of mines of this university. He served in this capacity till 1918 when he was appointed associate professor here. He worked in the experimental laboratory, National Lamp Works of the General Electric Co., as metallurgical

(Continued on Page 30)

ST. PAUL BUILDS NEW BRIDGE

Modern Reinforced Concrete Structure Will Replace Battered Crossing Now In Use

By Leonard Kleinfeld, M. E. '26



The New Robert Street Bridge from the East

AFTER much strife and delay, the city council of the city of St. Paul has finally decided to proceed with the construction of an urgently needed improvement. A new concrete bridge is to be built over the Mississippi River at Robert Street. This modern concrete arch bridge will replace the battered crossing now in use.

Toltz, King & Day of St. Paul are the engineers in charge of the project. They have designed a structure which in point of modernity is equal to any of its type.

Traffic on Robert Street is to be maintained throughout construction and, accordingly, a great deal of temporary work will have to be put in place to carry traffic.

The west half of the north approach will be built first simultaneously with the building of the east half of the south approach. The old structure within these areas will be removed, allowing traffic to move on the opposite sides of the old structure. The building of the temporary bridge structure will go forward from the beginning. Then, on the completion of the above mentioned areas the procedure will be reversed. The east half of the north approach will be built along with the west half of the south approach. In this way traffic will proceed as usual along the opposite sides.

Construction Is Under Way

Work has already been started. Pier No. 1 is now under construction. All steel from the old structure is to be salvaged in as good condition as possible.

The new bridge is to be mainly reinforced concrete, a type of construction rapidly coming to the fore for structural work. There can be no question, that for bridges up to a certain magnitude, reinforced concrete, on the score of beauty and permanence, is greatly to be preferred. Not only is the first cost less, but there is the greater advantage, that there are no subsequent costs for maintenance. A steel bridge must be periodically inspected and painted, otherwise it will rust out and disappear, and painting, in the case of a large bridge, is a costly problem. On the other hand, concrete

only permanent, but in coloring and appearance improves with age.

The proposed structure at Robert Street is to be of the concrete arch type. A viaduct composes the north approach to the bridge. This viaduct will be 136 feet long in four spans of varying length, built on soil at an elevation of plus 30 to 37. All elevations here given are from the St. Paul datum line.

Leading from the viaduct to the main arch are three reinforced concrete arches, also of varying length. The first is 103 feet from center to center of piers; the second, 79 feet; and the third, 112 feet.

The center arch is composed of both concrete and structural steel. The design differs from the original plan in that the arch extends above the roadway. This arch has a span of 264 feet and spans a 160-foot channel.

The spans from the center arch to the south viaduct are four in number, and are of varying length. Number 5 is a concrete arch of 130 feet, numbers 6, 7 and 8 are concrete arches spanning 128 feet each, center to center of piers.

The south member of the structure is a viaduct some 321 feet long in eight spans, built on concrete piles.

The aggregate length of the arches is 1,086 feet, and of the north and south approaches 449 feet, making a total roadway length of 1,535 feet.

All the piers and the south abutment are on wood piles, tipped with cast iron shoes. The river bottom is sand and gravel, the shore work is sand and clay. The north abutment is on soil.

Provisions Made for River Traffic

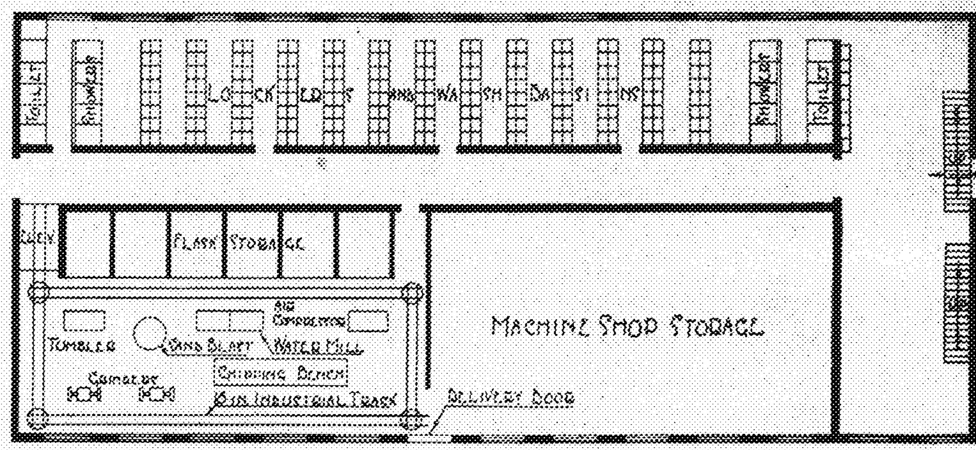
The river has a depth at midstream of about 32 feet at high water. Ordinary high water is at an elevation of about plus 5. The top of the roadway is at an elevation of plus 62.54 feet. This leaves a clearance of approximately 55 feet under the main arch at high water, quite enough for Mississippi river shipping.

The completed structure will contain about 47,000 cubic yards of concrete, exclusive of railings and concrete piles. Embedded in the concrete will be 1,020 tons of reinforcing steel. The structural steel,

PLANS ARE MADE FOR NEW FOUNDRY

Floor Is Designed to Meet Needs of Shop and to Conform With Space Allotment

By John H. Moffett, Inst. Foundry



BASEMENT PLAN

SOME time in the too far distant future the Department of Mechanical Engineering will secure a modern and adequate building, within which will be housed the foundry. At present, the prospect of securing the new quarters is very remote. The erection of new structures on almost every hand on the Campus and the talk about plans for the construction of more pretentious edifices are, however, furnishing an incentive for those directly concerned to consider the plans for the visionary foundry. Although the new shops still lie in the dark mists of the future, there is one certainty about them. It is their dimensions. These have been set by the requirements of the University Plan for the future development and beautification of Minnesota's Campus. When these limitations were set the groundwork was prepared for a plan which may be of use when the construction of the University's foundry is certain. The new shop will not be an ideal instructional foundry. The limitations of the University Plan have precluded that possibility. Nevertheless, the ideal condition can be applied as far as it will go under the restrictions. And that is the purpose of this article.

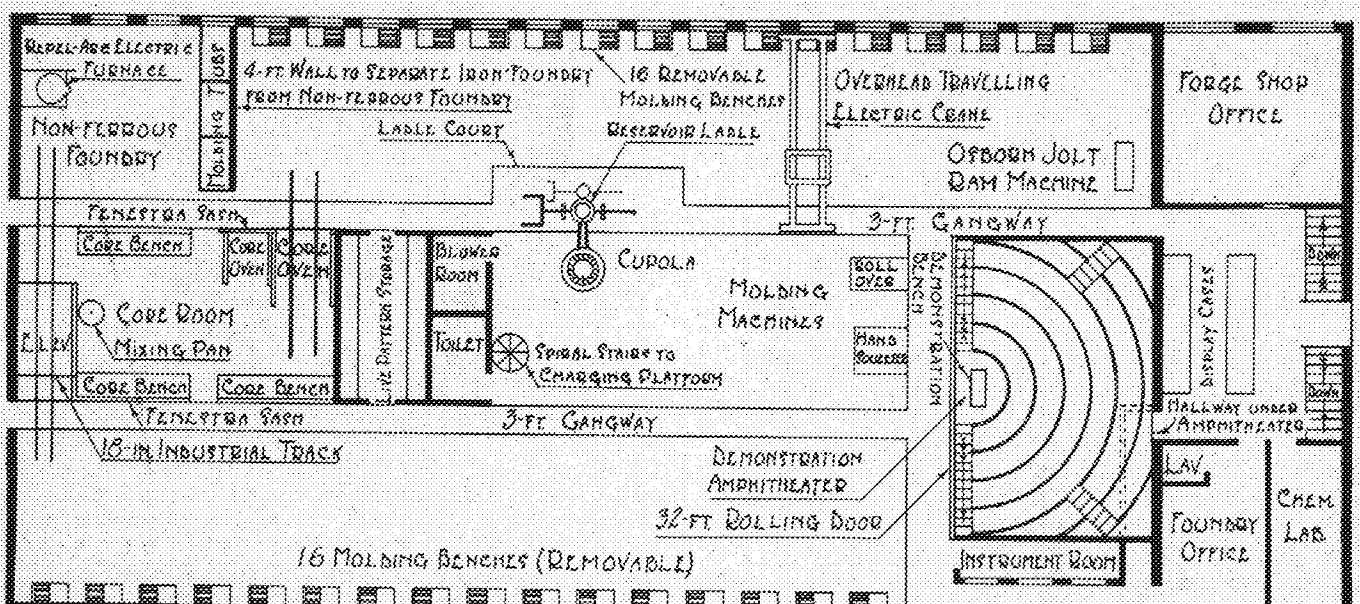
The planning of a school foundry should be reposed in the hands of one capable of satisfactorily executing it and no one except the experienced and practical foundryman can hope to successfully accomplish this result. One must have had long and intimate contact with the daily problems of a foundry to see and appreciate the trying conditions under which it operates. The shop should not be designed and arranged by one not conversant with its requirements. If it is, there is every probability that the shortcomings will be unalterable and a source of irritation for the practical foundryman who daily has to contend with the faults in the design or plant arrangement. The writer has had the opportunity to visit all of the schools of the Western Conference which operate foundries, and has not failed to see the mistakes in the designs of these shops. Some of the errors are nothing short of ridiculous to one experienced in foundry practice. One of the common mistakes is to place the steam radiators at the bases of the side walls. Such an arrangement denies the foundryman the convenience of keeping the sand heaps against the walls without the radiators rapidly drying out the molding sand. Furthermore, the molding benches or machines, if any are used, should be located out of the way, along the side walls. It is obvious that any radiators located there will be an impediment to this desirable arrangement. A heating plant should be designed to meet the requirements of the shop—not the shop to accommodate the idiosyncrasies of the common steam radiator. Modern commercial foundries use heating plants which have eliminated these objectionable features, while, at the same time, these plants have several other advantages not possessed by the common type of radiator. To mention a specific case: A prominent engineering school has recently completed her shop buildings at a cost of close to three-quarters of a million dollars; yet the new foundry is confronted with radiators at the side wall bases, and, furthermore, is compelled to keep its stock of spare flasks on the roof of the shop building, all because someone did not foresee the requirements of a rationally designed casting plant.

If a school foundry is designed on the basic principles of a commercial shop, it should, with minor modifications, serve the requirements of an instructional foundry. In the first place, the molding floor space should be arranged so that it will be at least twice as long as its width. Again, the side walls must be left free for ample daylight and the location of individual molding floors and benches for a sufficient number of the students of a class. Each pupil in foundry practice should have allotted to him a molding floor space of about 8 feet by 25 feet, and in these relative dimensions. Then to allocate the floor space in a projected new building it is merely necessary to limit the size of the classes to a definite number of students, and the hours for each class period with allowance for future increased enrollment.

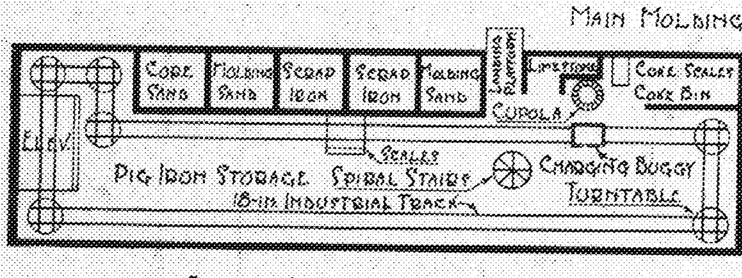
Since the new Mechanical Engineering building will be so constructed as to virtually preclude the expansion of the shops, it will be necessary to set a limit to the size of the classes, and plan the floor space accordingly. The one who will have charge of the planning of the new foundry will have no choice in respect to the proportion of its length to its width, because these dimensions have been made unalterable by the architect's plans which conform to the University Plan. The floor space allotted to the foundry of the proposed building is 63 feet by 125 feet exclusive of a hall space equivalent to an extra 10 feet in the length of this rectangle, some of which can be utilized. The direct foundry floor space then will be 7,875 square feet. The writer has devoted some time to what he considers requisites to an ideal instructional foundry. The floor plan of such a shop of 7,875 square feet, which, incidentally, is not sufficient to adequately accommodate a class of 60, should provide for a width of 50 feet and a length of 157.5 feet. Then with 47.5 feet of the ends used for auxiliary work, there will be available a direct molding floor space 50 feet wide by 110 feet long. It is seen that this proportion more than meets the 2 to 1 ratio requirement. If the same conditions are applied to the dimensions of Minnesota's future foundry there will be left a molding floor 63 feet wide by 77.5 feet long after 47.5 feet of the ends of the room have been devoted to auxiliary work. Although there would be more floor space available for auxiliary work, the rooms at the ends cannot be made any narrower to provide more space on the molding floors because the charging platform and the demonstration room then would be thrown out of a proportion necessary to their proper design. Since it is desirable to avoid a design which would provide a molding floor practically square, it then becomes necessary to depart radically from the conventional plan of a foundry.

The accompanying illustrations show to what extent the ideal arrangement can be applied to the proposed foundry. In the ideal foundry the demonstration amphitheater would be placed in the center of one end of the shop. In that position a class would have a full view of the shop and could see any piece of equipment or machine to which the instructor might have occasion to refer. In Minnesota's foundry this amphitheater will have to be set to one side of the center line of the shop to prevent the formation of six individual molding floors so short that they would be of no practical value. By placing the amphitheater to one side, three full length floors have, however, been made available for molding work. The amphitheater has been modelled after those used in medical schools, and is a feature that was not found in any of the school foundries visited. As planned, it will seat 62 students, and provide each with a space 3½ feet by 2½ feet. This ample space will make it possible for a pupil to stretch his legs occasionally; an opportunity for such relaxation is not afforded by the ordinary theater seat. Two flights of stairs have been provided to afford quick assembly and dismissal of a class, while the seats immediately in front of the demonstration bench, or the best ones, have not been eliminated by running a stairs up the center as is too often done in assembly rooms. Provisions have been made for tablet arm seats so that the pupils will have full opportunity to take notes. If a foundry course is properly taught, the students will have to take extensive notes, because no text-book can even hope to show to divergent minds the intricacies involved in foundry work. Too much depends on the human factor if molds are made by hand. The writer has not failed to see the lack of this feature in each of the school foundries he has inspected, and neither has he failed to reflect upon it and condemn it to his classes. The front of the amphitheater has been provided with rolling doors extending entirely across it. These doors can be rolled up to give the class a view of the shop, and can be lowered to keep the everlasting dirt and dust of the foundry out when the amphitheater is not in use.

The future foundry will be located on the second floor above the machine shop. Between these two shops and the forge shop above the pattern shop on the other side will be halls 20 feet wide. Since the foundry and the forge shop both will be on the second floor they can make use of this available space.



Main Molding Floor



Proposed Foundry for The University of Minnesota

Plan of Mezzanine Charging Floor.

In order to save as much as possible for the foundry molding floor, the office has been located in the hallway with the chemical laboratory. In addition, this location will insure that a minimum of dust from the molding room will enter it. This is another feature which few school foundries possess. No office door should open directly into the molding room, for if it does, the books and papers therein will have to be given a daily dusting if the dirt is to be prevented from rapidly accumulating on them. Commercial foundries have learned the lesson long ago, and, consequently, have provided against the vexatious condition either by placing the office in a separate building entirely, or by shutting it off with a vestibule.

Chemical Laboratory Is Essential

The chemical laboratory has been located adjacent to the office. It is admitted that the laboratory is hardly wide enough, but with the limited floor space at the end of the hallway no more room could be devoted to it. By placing the analytical desk, reagent shelves and the hood on one side of the room there will, however, be left a work space about 5 feet wide. The writer contends that an instructional foundry in an enginering or technical school should be provided with an analytical laboratory. If any foundry should be under metallurgical and chemical control, it is a foundry where engineering students are taught. These future engineers, when they go into the industrial world, will find that every effort is being made to dispense with the rule-of-thumb method to replace it with scientific control. The modern foundry is no exception. Where could the student be better taught what will be expected in the progressive foundries of the commercial world, than in a properly operated technical school foundry? It has been the source of a great deal of satisfaction to the writer to have visited at least one engineering school which realizes the importance of this feature of foundry practice, and has made ample provisions to care for it. Aside from the instructional use and value of the analyses made in the laboratory, the one who has charge of a school foundry should even have the analyses to carry on the successful production of the castings required.

A portion of the space on the side to which the amphitheater has been offset comprises the instrument room. This room has been provided for the care of the testing machines and pyrometers which, when not in use, certainly should be kept out of the molding room. This room is too small for the full use to which it should be put, because it will not be adequate for the testing machines which a progressive school foundry should have at its disposal. The physical tests applied to cast metals should be conducted in connection with the chemical tests if the pupil is to grasp the full importance of the product of a foundry as it affects engineering practice. A school foundry which aspires to rise above guesswork must be provided with pyrometers for nonferrous metal casting, particularly. Many of the alloys of these metals must be poured within narrow ranges of temperatures if sound castings are to be obtained. In addition to the pyrometers, there should be provided a modern transverse testing machine, a tension testing machine, and a Brinell meter for determining hardness.

It is unfortunate that more floor space is unavailable in the hallway for display cases. One of the foremost engineering schools of the Middle West, if, indeed, not of the country, has emphasized this feature in connection with its shop work. The foundry of this institution has devoted probably 300 square feet to show cases in which the manifestations of many of the factors entering into the production of molds and castings, good and bad, are exemplified. But the ideal conditions are being applied to the floor space which will be available when the new foundry is built, and not to what would be necessary if these limitations were not imposed.

In commercial foundries a space about 8 feet by 25 feet is considered sufficient for one workman making by hand the average jobbing class of castings. If these dimensions were used for ideal school foundry specifications, and applied to the floor space available in Minnesota's projected foundry, there would not be enough individual molding floors to accommodate a sufficient number of students out of a class of 60. Consequently, it is necessary to reduce the width of the floors to 6 feet. A width any less would not accommodate ordinary foundry work. With the design as decided best under the imposed limitations it was next to impossible to make the individual molding floors longer than 20 feet. This length, which is only 80 per cent of that considered desirable in the industrial foundry, it is hoped, will prove satisfactory. The floors in the present shop are 2½ feet longer, but here it sometimes is necessary for as many as four or five pupils to work on one floor. A condition like this, certainly, will not obtain in the new shop for, as the plans show, there will be available 35 individual molding floors, and should the demands ever make it necessary this number can be increased to 43 by moving the benches 1 foot closer together. This number is exclusive of four more which could be accommodated on the molding machine floor. At the head of each floor has been placed a removable molding bench. The bench should be provided with sockets which can be attached to hooks built in the walls when the masonry work is being done. An arrangement of this kind will have two advantages.

Tools Will Be Kept at Benches

One is that the bench can be removed and stored away in the basement should it ever be found desirable in case a floor was to be devoted exclusively to floor molding. The other is that the floor will be left free beneath the bench, and, thereby, facilitate the handling of the molding sand and the cleaning of the floor. In contradistinction to the confusion that exists in the present shop where a pupil has to sprawl his tools and equipment on the floor to use a flask which should be handled on a bench, the future foundry has provided a space of 2 feet between each individual molding floor where the larger tools such as riddles, shovel, bellows and floor rammer can be hung. Since practically all of the tools in the shop will be kept at the floors where they belong, it is not necessary to make provision for a tool room. In referring again to the molding benches the ample size provided by a width of 2 feet and a length of 4 feet should be called to the reader's attention. These benches are of commercial size as compared to the type ordinarily used in school foundries where a size of 2 feet by 1¾ feet is considered sufficient. It will be noted that each bench has been placed at a window to provide plenty of daylight for a class of work which requires a flood of it.

(Continued on Page 24)

SOME SUGGESTIONS FOR ENGINEERS

Do You Have An Orderly Study Table, Is It Conducive to Good Work?

By L. T. Sogard

(Reprint from Wisconsin Engineer)

AN engineer's room is his office; his own study table is the place where he obtains most of his college training and knowledge. There, too, he forms his habits of studying, of attacking problems, of writing reports. Much of what occurs over that table in his four years at school will become a part of him, and there he will acquire many of his permanent professional habits.

Engineering students have much work to do and in order to do good work they must function efficiently. A few suggestions gleaned from the writer's four years at college, plus those he has gathered from observation of other engineering students, are presented in the hope that they may help others, especially underclassmen, in getting their school affairs in such shape that they may work to better advantage.

Order is essential. Chaos and confusion on the study-table boost the business of the movies and the pool-room. It takes all of the ambition out of a fellow to have to sit down before a cluttered table and endeavor to work. Have your books in some kind of a case or rack, within easy reach, and keep them there always, except when they are in immediate use.

When you buy supplies, get enough to last several months—better still, a semester. Nothing is more exasperating to yourself, and to your roommate, than to be continually out of paper, report covers, pencils, and other material of which you use a great deal. Buy paper clips, fasteners, and thumb tacks by the hundred, not by the dozen. The chances of having them on hand are increased greatly thereby.

Almost everyone uses some sort of a loose-leaf, ring-binding notebook. To his notes therein he will often wish to add miscellaneous sheets which are not punched for the rings. The usual practice consists in forcing these sheets over the open edges of the rings with very unsatisfactory results. An inexpensive paper-punch will produce an incomparably better job and, furthermore, insure the permanence of the sheet. This is but one use of the paper-punch, a tool as invaluable to the engineers as a 30-60 triangle.

How often in the course of your four-year sojourn here do you sign your name to problems and other papers which you turn in? In how many books have you scribbled your name? Figure it out and you will find that it totals quite a bit of penmanship and time. Yet for twenty-five cents you can obtain a rubber stamp of your own name which will speedily print it in a uniform and legible fashion. However, don't sign your checks with it.

There are certain places in your textbooks, particularly in handbooks, to which you wish to refer often. The easiest solution to what can be an arduous and exasperating task is to glue small thumb-tabs to those particular pages and label them. Reference to them is simplicity itself. If you are skeptical try it on your Cambria.

Glue is a prime necessity, yet there probably is more glue borrowed among engineers than cigarets. It can be purchased in tubes, jars, bottles, and jugs ranging in price from ten cents to infinity. Why say more?

Unless your memory is exceptionally keen, jot down your assignments, tasks to be performed, and appointments to be kept. A little system in this is a great saver of time and worry. Have some sort of a daily date-pad on your desk on which you can note, at any time, for any day, anything from a reminder to buy some more shoestrings to an appointment with the governor of the state. Assignments, if kept together in chronological order, are a great aid in reviewing for quizzes. The practice of marking them in texts is often misleading and is of little value when the book is not followed in the order in which it was written. One engineer, whom I know, sits down at intervals and makes a list of the reports, problems, and other scholastic work to which he has been detailed. This he tacks up in front of him with the additional underscored warning at the bottom, "Work Like Hell." As each task is completed he scratches out its notation.

Next to the Pardon-Me-Have-You-A-Match fiend is the Say-What's-the-Date-Today roommate. Calendars are as free as the air. If you haven't got one on your wall you are either indifferent, dub, or hopeless. But if you do own one, don't commit the unpardonable crime of asking your roommate the date—merely look at the calendar.

Clip-covers for loose sheets provide a satisfactory means of keeping current papers. Many carry their papers between the leaves of their textbooks. One has only to drop a book so filled but once on some windy day and he is immediately converted. Many use the leather portfolios, or brief cases, in which they can readily transport books, papers, slide-rule, and instruments. The suitcase effect is abhorred by many, but there is much in favor of them.

If you have notes, problems, or reports which you wish to keep for future reference, bind them in some manner. Any stationer will punch them and provide them with cardboard covers for ten or fifteen cents if you will trouble yourself to take them to him. Some prefer a regular binding; this is more permanent but does not permit of further additions.

Much more could be said, but all engineers have some ingenuity and, doubtless, many have plans and ideas better than these. They should be taken in the light of suggestion and not as a working model. The satisfaction obtained by working with all of your materials and tools at hand and with some semblance of system can be truly appreciated by those who do and, more particularly, by those who didn't but now do.

ALUMNI NEWS

CIVILS

The other day we received a card from **Louis J. Larson,** C. E. '14 and '15. Louis is an Associate in Mechanics at the University of Illinois at Urbana, Ill. Previously, he was engineer for the Lumber Tie & Timber Vulcanizing Co.

E. B. Sherwood, C. E. '20, recently Production Engineer for the Roxana Petroleum Corporation at Arkansas City, Kan., can be addressed at 2619 Twenty-third Ave. No., Minneapolis. He came here for a short visit and is accompanied by Mrs. Sherwood and a five months' old daughter, Margaret. Mrs. Sherwood was Margaret Sutherland, S. L. A. '20.

"Spike" Garzon, C. E. '24, formerly Alumni Ed. of the Techno-Log, has been acquired by Peppard and Fulton, Engineers, for work on reinforcing steel. "Spike" will be located at Ashland, Wis.

S. H. Ingberg, C. E. '09, is Physicist for the Bureau of Standards of the U. S. Department of Commerce. He is in charge of investigations of the fire resistive properties of building materials.

"Herb" Gillard, C. E. '24, is working for the League of Minnesota Municipalities. He is touring the state selling advertising to magazines.

The Minneapolis Steel and Machinery Co. has grabbed off **M. J. Brody and M. W. Lazarus,** both C. E. '24. It also has in its employ **Everett Thompson,** C. E. '23, who is working in the structural drafting department. Everett was among those present Engineers' Day.

"Swede" Bachelder, C. E. '24, and **George Sprehn,** C. E. '24, are both working for the Highway Department. "Swede" is located at Cloquet, Minn.

I. V. James, C. E. '15, is Supervising Structural Engineer in the Chicago office of Lockwood, Greene & Co., Engineers. Since leaving school he has done designing for the Panama Canal project and for the New Orleans Harbor Navigation Canal.

"Pete" Larson, C. E. '24, is at Ashland, Wis., working for the Soo Line Ry.

When you are in Fergus Falls, Minn., look up **"Ray" Johnson,** a true Knight of St. Patrick of the class of '24. "Ray" is another one of the boys who is working for the State Highway Department.

Walter C. Brenchly, C. E. '15, is Contracting Engineer for the Minneapolis Steel and Machinery Co. He has offices at Salt Lake City, Utah.

We have just learned that **Ed Gould,** C. E. '20, has a seven months old baby.

John G. Anderson, C. E. '99, is Assistant Engineer of Structural Design for the Soo Line Ry.

Geo. Cottingham, Jr., C. E. '15, is maintenance of way engineer with the C. G. W. Ry. He formerly was employed by the N. P. Ry. as engineer on heavy construction work and later as Roadmaster.

Ervin J. Miller, C. E. '09, is now Asst. Bridge Engineer of the Minnesota State Highway Department.

Forest V. King, C. E. '13, is now with the So. California Edison Company. Previous to his employment by this company King was on the Minn. Highway Commission and the U. S. Bureau of Public Roads.

Harold L. Peterson, C. E. '16, is employed by the Nordyke & Marmon Company as manager of their Indianapolis branch.

Axel E. Elfstrum, C. E. '11, is working in the City Engineer's office at San Francisco, Cal. In his own words, he has done "civil, mechanical, and mining engineering throughout the western states since 1911."

Rudolph T. Elstad, C. E. '19, has been employed as engineer with the Oliver Iron Mining Company, at Coleraine, Minnesota, since his graduation.

Dewey F. Mattson, C. E. '22, was married on Thursday, April 24th, to Miss Lila Charlotte Brown, of Two Harbors. The couple will be at home at Two Harbors after May 15th.

L. E. Teberg, '22, is at present employed as engineer in the bridge department of the Great Northern Railway Co.

Donald W. Webster, C. E. '14, is now Asst. Construction Engineer, Minnesota State Highway Department. Webster has been in the highway service since 1914, starting as Asst. Highway Engineer of Lyon County, Minnesota.

MECHANICALS

Fredrik W. Hvoslef, M. E. '17, is assistant chief engineer at the Detroit plant of the U. S. Radiator Company. He has been in the service of that company since 1919 and is engaged in boiler, radiator, and equipment design.

John H. Murray, M. E. '17, is a member of the firm and general superintendent of the J. C. Stewart Co., of Owosso, Mich. Mr. Murray was active in athletics at the University and became a member of Sigma Delta Xi, national honorary athletic fraternity.

Among the visitors at the University Engineers' day was **E. A. Nordstrom,** M. E. '22. Mr. Nordstrom is construction superintendent of the Standard Oil Co., at La Crosse, Wisconsin.

Ralph H. Rawson, M. E. '07, is a member of the firm of Goss & Rawson, consulting timber engineers, 1124 Yeon Building, Portland, Oregon.

Mr. O. T. Rood, M. E. '23, died at La Grange, Illinois, Wednesday, April 9, 1924, from complications following mastoid trouble. Mr. Rood, after completing a year of graduate work at Minnesota, went to the Western Electric Co., where he spent a year taking their student course. After finishing this course he had been assigned to technical development work, and was making a good start on his regular assignment.

Thursday, April 24, marked the date of the marriage of **Chester R. Marshall**, M. E., '23, to Miss Dora Petersen, of Minneapolis. **Mr. Grant Bergsland**, M. E. '23, of La Crosse, Wisconsin, was the best man. Mr. Marshall and Mr. Bergsland were classmates at the University. Mr. Marshall is at present fuel engineer at the Riverside Station of the Northern States Power Co. He is a member of Theta Tau fraternity and also Pi Tau Sigma, honorary Mechanical fraternity. Mr. and Mrs. Marshall are residing at White Bear, Minn.

M. J. Williams, M. E. '20, is now production superintendent of the Washburn Company, at Chicago. After graduation Williams was employed as Asst. Mechanical Supt., Minneapolis Tribune, and later as Research Statistician, Federal Reserve Bank, N. Y. City.

Carl C. Muller, M. E. '18, is employed by the Standard Conveyor Co., of St. Paul.

Paul E. Francis, M. E. '18, has been with the North Western Fuel Co. since June, 1920, and is now fuel engineer.

Robert P. Blake, M. E. '97, is Master Mechanic of the Montana division of the Northern Pacific Railway. Mr. Blake has held many positions since his graduation, but has always been in the service of the N. P. Ry.

James S. Lang, M. E. '07, is president of the J. S. Lang Engineering Co., of Boston, Mass. Mr. Lang became a member of Sigma Xi honorary scientific fraternity while at the University.

Sheldon S. Hibbard, M. E. '23, has joined the ranks of teachers and is an instructor of mathematics and mechanics at the Y. M. C. A. night school at Duluth, Minn. Mr. Hibbard was formerly an estimator for the Clyde Iron Works of Duluth.

Harold R. Rosendahl, M. E. '22, is the district manager at the Pittsburgh office of the Mahr Mfg. Co. of Minneapolis. After his graduation he was employed at the home office for six months as draftsman, and then entered the sales department. His address is 123 N. Negley Ave., Pittsburgh, Pa.

E. A. Nordstrom, M. E. '23, has been with the Standard Oil Co. since graduation. He has recently been transferred from the Minneapolis office to La Crosse, Wisconsin, where he will have charge of service station construction work.

According to **Arthur W. Kumm**, M. E. '22, teaching is an exceedingly interesting profession. He is an instructor at Rice Institute, which is located at Houston, Texas. This school has an endowment of 13,000,000 dollars, and Mr. Kumm predicts that it will become one of the most important centers of learning in the South.

Raymond C. Ascher, M. E. '23, was among the alumni who returned for Engineers' Day. He informed us that he has left the employment of the Bethlehem Steel Co., and has accepted a position with the International Harvester Co.

ELECTRICALS

George P. Svendsen, E. E. '08, recently published a series of articles on "Distributing Overhead in Motor Repair Work" in The Electragist.

M. E. Anderson, E. E. '01, is Assistant Examiner of Patents at Washington.

Roy E. Thompson, E. E. '00, is Chief Engineer of San Diego Consolidated Gas and Electric Company.

Halsey H. Wilcox, E. E. '15, is now district equipment supervisor of the Western Union Tel. Co., at Minneapolis. Halsey has been with the Western Union Company since his graduation in 1915.

S. G. Reque, E. E. '01, is Chief Engineer of the Penn Power and Light Co., with headquarters at 802 Hamilton St., Allentown, Pa.

Chas. E. Tuller, E. E. '01, is in the patent department of General Electric Company, at Schenectady, N. Y.

Christopher Hoff, E. E. '06, is vice president of Lee-Hoff Mfg. Co., St. Paul.

O. B. Roepke, E. E. '06, is Assistant Examiner of Patents at Washington.

W. A. Zimmer, E. E. '06, is Traffic Engineer with the Northwestern Bell Telephone Co., at Omaha.

H. G. Stone, E. E. '06, is an Electrical Contractor and Dealer at Los Angeles.

G. R. Shuck, E. E. '06, is teaching in the Electrical Engineering Department at the University of Washington, Seattle.

E. L. F. Weber, E. E. '06, is a Consulting Engineer at 723 Seaboard Bldg., Seattle.

J. E. Smithson, E. E. '07, is President and General Manager of the Oregon-Washington Telephone Company, with headquarters at Hood River, Ore.

G. W. Uzzell, E. E. '07, is Vice President of Petroleum Engineering Organization, 936 Mayo Building, Tulsa, Okla.

R. J. S. Carter, E. E. '08, is with the Carter-Mayhew Mfg. Co., Minneapolis.

G. H. Hoppin, E. E. '08, is General Manager of Stout Engineering Laboratory, 6282 Beaubien St., Detroit, Mich.

A. W. Schoepf, E. E. '08, is an engineer with Monongahela Power and Light Co., with headquarters at Fairmont, W. Va.

F. E. Murrish, E. E. '09, is in business at 1015 Security Bank Bldg., Los Angeles, Cal.

J. W. Hornbrook, E. E. '09, is in the Chicago office of the Westinghouse Lamp Co., and may be addressed at 900 Dakin Ave., Chicago.

G. F. Benedict, E. E. '03, is reported as Chief Draftsman at Puget Sound Navy Yard, Bremerton, Wash.

L. G. Rask, E. E. '03, is an Engineer on Marine Propulsion Apparatus with the General Electric Company, Schenectady, N. Y.

V. E. Goodwin, E. E. '04, is Managing Engineer in the Lightning Arrester Department of the General Electric Company, Pittsfield, Mass.

L. S. Billau, E. E. '05, is Assistant Electrical Engineer of the Baltimore and Ohio Railway, with headquarters at 607 B. & O. Bldg., Baltimore, Md.

Frank D. Coleman, E. E. '05, is Superintendent of the Billings District of Montana Power Company, with office at 3104 4th Ave. N., Billings, Montana.

C. Bradley Gibson, E. E. '05, is Manager of the Metal Mining and Chemical Section of the Industrial Department, Westinghouse Electric and Mfg. Co., at East Pittsburgh, Pa.

E. H. LeTourneau, E. E. '05, is with the Standard Oil Company, at 26 Broadway, New York City, in charge of repairs on their marine equipment.

R. A. Lundquist, E. E. '05, is in charge of the Electrical Export Division of the U. S. Department of Commerce, with headquarters at Washington, D. C.

G. M. Albrecht, E. E. '06, is patent attorney for Allis-Chalmers Mfg. Co. at West Allis, Wis.

Martin Cornelius, E. E. '06, is a Switchboard Engineer for the Westinghouse Electric and Mfg. Co., at East Pittsburgh, Pa.

C. E. Magnusson, E. E. '96, is Dean of the College of Engineering, University of Washington, at Seattle.

G. P. Swensen, E. E. '08, is President and General Manager of the Boustead Electric and Manufacturing Company, Minneapolis.

Frank Swanstrom, E. E. '08, is Chief Engineer of Electric Machinery Mfg. Co., Minneapolis.

Oscar P. Anderson, E. E. '10, is Commercial Engineer, Edison Lamp Works, Harrison, N. J.

Oscar V. Anderson, E. E. '10, is Superintendent of Distribution, Toronto and Niagara Company, at Toronto, Canada.

V. S. Beck, E. E. '10, is a General Contractor, at 1137 Plymouth Bldg., Minneapolis.

C. M. Jesperson, E. E. '10, is Secretary and Treasurer, Southern Manganese Corporation, Anniston, Alabama.

J. H. Pengilly, E. E. '11, is with Brown & Pengilly, 607 E. 4th St., Los Angeles.

G. W. Wilson, E. E. '11, represents the American Forge Company at 25 Tehama St., San Francisco.

R. C. Mathes, E. E. '13, is a Research Engineer with Western Electric Company, 463 West St., New York City.

E. W. Merriell, E. E. '13, is Assistant Manager, Minnesota Mazda Lamp Division, Minneapolis.

C. A. Pardee, E. E. '13, is Treasurer for Miller & Pardee, Manufacturers, 625 W. Jackson Blvd., Chicago.

F. W. Hoorne, E. E. '15, is a Captain in the U. S. Army, at present in charge of the Signal Corps unit of the R. O. T. C. at the University of Michigan.

Theo. Lagaard, E. E. '15, is a patent attorney in St. Paul.

D. K. Gannett, E. E. '17, is a Research Engineer with the American Tel. and Tel. Co., at the Broadway Office, New York City.

E. C. Melby, E. E. '17, is the manager of the engineering department of New York Oversea Company, importers, at 44 Beaver St., New York City.

E. J. Teberg, E. E. '17, is a lighting specialist for the Public Service Company of Northern Illinois.

Frederick Klass, E. E. '19, is with the Minneapolis office of the General Electric Company.

Axel A. Turnquist, E. E. '16, is now in business as Electrical Contractor at Duluth, Minnesota. After being discharged from the army Axel was employed as junior engineer of the H. L. Doherty Company, Toledo, Ohio, and also as instructor in the Eveleth Junior College.

Two of our "Lost Engineers" have been found. **Samuel A. Berg,** E. E. '21, is working for the Westinghouse Electric Co. His address is 327 Pelt St., Wilkinsburg, Pa. **Lyman D. Taylor** has been located at the Electric Controller and Manufacturing Co., Cleveland, Ohio.

Richard M. Peterson, E. E. '20, is now employed by the Northern States Power Co., at St. Paul. Richard has been with the Northern States since 1921. He previously was employed by the N. W. Bell Telephone Company, at Minneapolis.

J. A. Thaler, E. E. '00, has recently returned from a year's leave of absence for study at Massachusetts Institute of Technology, to his work as Professor of Electrical Engineering at College of Agriculture and Mechanic Arts at Bozeman, Mont.

H. S. Langland, E. E. '19, is an appraisal engineer, at present making a valuation of the Minneapolis Gas Light Company plant.

A. L. Abbott, E. E. '97, has recently resigned his position as Vice President and General Manager of Commonwealth Electric Co., St. Paul, for a more important position in St. Louis, where his address is 3649 Bell Avenue.

Boyd Phelps, '21, is chief engineer of the Grimes Radio Engineering Corporation. Phelps has been active in the field of radio engineering, during the last few years having been in charge of the radio department of the Findley Electric Company of Minneapolis, Assistant Editor of the Q S T radio magazine, and engineer with the C. D. Tuska Company, Hartford, Conn.

ARCHITECTS

Ralph Hammett, Arch. '21, has been awarded the Nelson Robinson junior traveling fellowship prize from Harvard university, according to word received by his parents. The award was made to Hammett because of his scholarship record.

MINERS

Trygve Johnson, M. '22, announces his engagement in March to Miss Hulda Hammer, of Galesville, Wisconsin. Mr. Johnson, "Trig," was very active while at the University, having been president of his class his Junior and Senior years, and captain of the 1919 football team. He is a member of Theta Chi and Sigma Rho fraternities, and also Alpha Pi Omega, an honorary Mines fraternity. Since his graduation, Mr. Johnson has been employed by the Northern Pacific Railway Co., and he is now inspector of construction. His mailing address is 1029 Fourth St. S. E., Minneapolis.

DOWN AROUND MT. OLYMPUS

Dean W. R. Appleby of the School of Mines has received a letter from Charles F. Jackson, E. M. '07, in which he tells of his interesting work as superintendent for the Cyprus Mines Corporation, Skouriotissa, Cyprus. He says, "The early history of this mine is all legendary and is obscure. It was worked by the Phoenicians prior to 600 or 700 B.C., and later by the Romans during the period of occupation, 107 B.C. to 395 A.D., and has probably not been worked since until this company began operations in 1914. In our present operations we frequently encounter ancient workings, some of which are filled with waste which is now as hard as the original rock. Other ancient workings are still open and we often find pieces of mine timber which, shut off from air, are in an almost perfect state of preservation. There are slag dumps on the surface near the mine containing an aggregate of perhaps two million tons. The Phoenician slag is a bright red and the Roman slag almost black. The low copper content and chemical composition shows that these early metallurgists possessed considerable skill.

"About ten years ago an enterprising American mining engineer, scouting for Los Angeles capitalists, visited the island to search for the legendary lost mines of Soli, and recommended drilling of the entire district. This located the ore body, a mass of iron pyrite containing about 50 per cent sulphur and 2.5 per cent copper.

(Continued on Page 27)

EDITORIALS

A SOLID FOUNDATION

The first item in the construction of a skyscraper is the laying of a foundation. Sometimes a few weeks are required, while at others perhaps months are spent below the ground level before the visible part of the structure is started. The amount of work and the depth of it varies with the location as does the student's preparation vary for the type of field which he intends to enter. Business men tell us that the foundation is the most important part of the building and that the same is true of the young man's career.

Our university life is only a foundation for what is to come. It is our chance to place solid ground under our feet. Study alone will not make a solid foundation any more than gravel will make a good wall. Study must be supplemented by activities and social life with enough common sense to cement the whole into a firm base upon which to build. A common question among the men looking for new material is "What has he done outside of his studies?" and "Did he make it a success?" Some seem to think that they are not being watched and that they can shirk all responsibility now and make up for it later, but such is not the case. Big business men are looking for the college men who can be trusted to accomplish whatever they agree to tackle.

In our college we have several excellent agencies, through which we can prove our worth. There is the Techno-Log, the Technical Association, the Arabs, and numerous honorary organizations, all of which furnish excellent opportunities for doing things. Get out and make a place for yourself.

Do not say you will do a thing when you know you are not capable. Do not take on too many things at the same time but remember that there are 525,949 minutes in a year during which you can accomplish great things. Let us lay a real foundation on which to build.

Some of the Things That Occur to Me That Might Be of Interest

A young engineer usually has difficulty in getting a job such as he wants. In some cases there are no such jobs. If a man expects to be a mining engineer he should make up his mind to do a considerable hard menial work at the start. This does not necessarily mean work of an unpleasant kind, but work that demands constant concentration.

After the graduate is out of school and ready for work, it is well to take most any kind of work offered. This will give the graduate a chance to find out a lot of things that will be useful later on. The more he associates with workingmen, the better, so as to get their viewpoint of how they are treated by the employer. He will have a better idea as to how to treat and deal with men when he has charge of work. An engineer usually doesn't get very far unless he can handle men, and the only way to learn this is by experience. A job as foreman is excellent training. The rule to follow is to treat all alike and remember how you considered the boss when you were a beginner.

Try to find out what the boss wants accomplished, then do your best to help the work along. Don't wait to be told every move to make, but take all the responsibility that seems proper and go ahead.

O. J. EGLESTON,
Manager of United States Smelting,
Refining and Mining Company.

THE ENGINEERS' YELL

Screws! Nuts! Bolts! Gears!
Minne-sota Engi-neers! Rah!

In some ways, that's a good yell. Simple rhythm, easy to learn, snappy. It has one shortcoming, however. It has nothing to do with the things an engineer is interested in. It would be a good yell for the Northwest Auto and Tractor School or the Chicago College of Carpentry. It would typify their work. But what has an engineer, as such, to do with screws, nuts, et cetera?

Our yell is inelegant, and it fails to voice the dignity of a profession that habitually does big things in a big way. It recites details instead of worth while factors in achievement.

To replace it, the following has been suggested:

Bridges! Motors! Bevel gears!
Minne-sota Engi-neers! Rah!

The proposed yell has all the snap of the old; in addition it covers the typical activities of all branches of engineering. What is your choice?

A. R. M.

WHITHER ARE WE DRIFTING?

It is a mark of the unrest of the times that our educational system is continually under fire. Policies that have been accepted for generations are being revised or discarded for something newer and supposedly better.

In engineering education the present cry is "training for leadership." The engineer must not be content to be merely a technical man. He must rise above his technics and become the director rather than the subordinate. To prepare him for this service, the engineering school is to train him in law and economics, in accounting and public speaking.

Insofar as such courses are pursued without detriment to the student's interest in pure engineering, they are of undoubted benefit. But any relaxation in technical requirements in favor of other courses is of questionable wisdom. We cannot agree with those students and those educators who seem to think that technic is a relatively minor matter. The graduate who forgets his design and becomes a promoter may be successful but he surely is not an engineer.

A. R. M.

COLLEGE NEWS

ARCHITECTS

PLANS MADE FOR JUBILEE

Plans for the Architects' Jubilee, May 23 and 24, are rapidly being perfected. New mural decorations to give a festive air to the normally gloomy halls of the department are being designed by Carl Matthias Wise, Dorothy Brink and Ted Prichard. For principal speaker at the Jubilee Banquet Mr. Cass Gilbert, of New York, one of the nation's most prominent architects, has been obtained. All architects of the state are invited to attend this function, which marks the tenth anniversary of the founding of the department.

THE HELPING HAND

The Arabs Club is very prone to boast its self-sufficiency; and indeed, I tell you frankly, it has just cause to do so. But self-sufficiency often has a note of pathos in it (for instance, the proverbial spinster), and perhaps it was this note of pathos that drew so much in the way of convivial helpfulness to the succor of the Arabs during the production of *Riquiqui*. Surely no bosom could remain unmoved before the sight of a band of lusty and sweating Engineers with five thumbs on each hand painfully running seams down a million or two yards of mosquito bar.

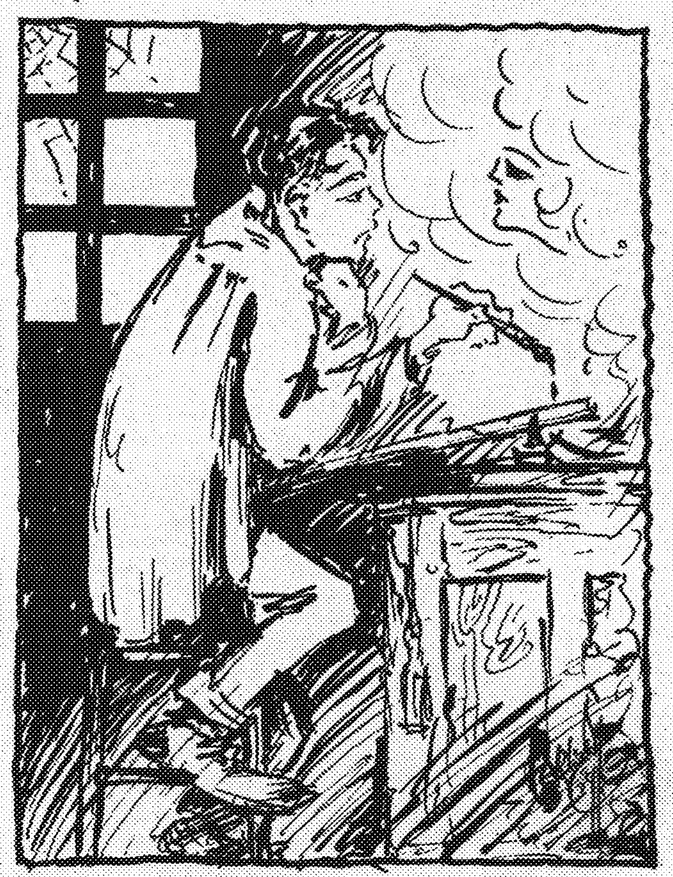
And so it was that a number of angelic visitants came down on merciful wing to aid in the grand preparations. Dorothy Brink was the first of the heavenly band, and the most ardent. But in her train came many another: Dorothy Mann, Catherine Burke, Rhoda Coté, Martha Sampson, Eleanor Brooke, Alberta Eberhart, Muriel Ehrenberg, Mary Slocumb, Grace Cameron, and perhaps even more. And so the seams were sewn, final touches artfully given to the costumes, shells fabricated, and a dozen other tasks done up in a neat and jolly manner. Gladys Hernlund, during the first chorus rehearsals, acted as accompanist, and very patiently, too, I tell you frankly. And the fine translucent bubbles which so quaintly and delicately rounded out to completion the long-sought sub-sea atmosphere in the play were blown from O! what precarious heights by Dorothy Brink, Dorothy Mann, Helen MacGregor, and Catherine Burke, assisted by the Arabs' mascot, "Frank," the *Saturday Evening Post* boy.

Wally Lord, too, just seemed to drift into the ranks of the laborers, and a decided asset to the cheerfulness of things he was to be sure, I tell you frankly. But Wally had his reward on earth and not (yet) in Heaven, for on the Saturday of *Riquiqui's* ultimate triumph he was elected into the Arabs with the most vociferous acclaim ever received by any entrant. Vive Wally! Vive Frank! but most of all, Vivent the angel-visitants!

SUCH MODEST DEMEANOR

The April, or "Engineers' Day" edition of the *Ski-U-Mah* was not barren of work done in the Architectural department. Joel Carlson designed the cover; Glanville Smith wrote *The Last Memoirs of Saint Patrick*, a story reminiscent of Lord Dunsany, Thomas Moult, Stephen Leacock and a dozen others; Dorothy Brink, Wally Lord, and Joel Carlson embellished the humor pages with various chaste drawings; and the frontispiece, a drawing of the very earliest construction work on the Stadium in a manner which one may honestly call exquisite, was sketched by "Izzy" Silverman. (And on what a cold day, too!) So does greatness come into its own.

Pi Alpha, honorary fraternity in art, has this year initiated three students from the department of architecture; in the winter quarter, Clyde Lighter; in the spring quarter, Theodore J. Prichard and Joel S. Carlson. Harold Heins, also of the College of Engineering, was initiated in the spring quarter. Pi Alpha's annual exhibition of work done by its members—original drawings for *Gopher* plates and for the *Ski-U-Mah*, outdoor sketches, fine lettering, architectural renderings, etc.—will take place in the Blue Hound Studio, Publications Building, on May 28.



"A good Architect must have vision." Is this what they mean?

MINERS

JUNIORS TO RECEIVE INSTRUCTION IN MINE RESCUE

In the itinerary for United States Bureau of Mines Rescue Car No. 10, published in the Skillings' Mining Review April 19, notice was given that the car is to be at the University of Minnesota May 5 to 10. At this time the Junior Miners are to receive instruction in mine rescue, including fifteen hours of work with gas masks. At the same time about sixty members of the Minneapolis Fire Department will receive instruction in the regulation first-aid course given by the Bureau of Mines.

Engineer in charge is W. H. Carrick; foreman miner, H. Brockbank; and first aid miner, H. J. Brusseau.

MINERS HOLD TWENTY-SIXTH ANNUAL BANQUET

Tuesday evening, April 22, the twenty members of the Senior Class in the School of Mines were the guests at the Miners' twenty-sixth annual banquet held in the Colonial Room of the West Hotel. Following tradition, the banquet was given by the Junior Class, with "Vic" Mann, Bernard Larpenteur and "Ed" Hennen in charge of arrangements. "Vic" Mann, president of the Junior Class, acted as toastmaster and opened the evening by calling on B. J. Larpenteur for a speech of farewell to the Seniors. The response was given by Leslie M. Case, president of the Seniors. Everett Van Duzee touched the lighter side of the evening with an original hula-hula dance, and a quartette composed of Moe, Jensen, Stewart and Barker entertained the gathering with some of the Miners' songs. Elliot H. Griffith revealed a hitherto unknown accomplishment when he read a poem of his own composition, entitled "A Mining Engineer." A banjo duet by Moe and Barker, followed by a few words from the Freshman Class in the person of O. O. Annes, their president, concluded the evening's festivities.

SOPHOMORES AND JUNIORS COMPLETE SCHOOL YEAR WITH EXTENSIVE FIELD TRIPS

The close of Examination Week in the School of Mines, April 28 to May 3, found the Sophomores and Juniors with the class work for the spring quarter completed.

Fifteen Sophomores were given notice to report Monday, May 5, at Crosby, Minnesota, on the Cuyuna Iron Range, where they will spend seven weeks in surface, open pit and underground surveying. They are scheduled to do their underground work in the Armour No. 2 Mine. This mine was also visited by the Sophomore Class of last year. After the completion of their work at Crosby, the students will spend a day in the steel plant at Duluth and will wind up the trip with two weeks of field geology on the Mesabi and Vermillion Ranges near the towns of Virginia, Mountain Iron, Eveleth, Gilbert, Biwabik, Tower and Soudan.

To the Juniors falls the lot of taking one of the best trips to western mining camps that has ever been taken by any class in the School of Mines. On Friday afternoon, May 16, they will board the rattlers for Arizona, via Kansas City, Missouri; La Junta and Colorado Springs, Colorado; Albuquerque, New Mexico, and El Paso, Texas, winding up the jaunt across country at Bisbee, Arizona.

Outside of short stops at Colorado Springs and El Paso, the greater part of the work will be confined to the mines and metallurgical plants near Bisbee. At the close of the trip, most of the men expect to obtain jobs working on the small end of a No. 2 shovel in the copper mines of Arizona, returning to school in September. The return trip that most of the class is contemplating will take them through Los Angeles, 'Frisco, Portland, Seattle and Vancouver.

DR. T. REED LECTURES TO MINERS

Dr. T. Reed gave two talks to the School of Mines Society. The first was a discussion of the value of iron ore, the other was a talk upon the ventilation of the St. John del Rey mine in Brazil. This mine is the deepest in the world, going down to the depth of 6,226 feet from the surface. Dr. Reed is the Acting Assistant Director of the Bureau of Mines in Washington. He recently returned from an extended trip through South America.

CIVILS

OBITUARY

Every once in a while a dark cloud hovers over our midst and deprives us of a bright shining light. Usually in a misfortune of this kind we can visualize the end of a long period of suffering, but this time we cannot—suffering has just begun. It seems an outrage that such an occurrence cannot be avoided; it must be, therefore we shall bear our sorrow bravely.

S. Caryl Chapin, C. E. '24, has passed over the great divide, but not alone. His passing out was quiet and inconspicuous except that we noted his absence from our midst for a short time and when we found him again, lo and behold! his address had changed. Yes, it is true and Her name was Esther Jane Hill, of Kansas City. Well boys, don't be bashful. Call on "Chape" at his new abode at 1801 La Salle St., and try some of his wife's cooking. "Chape," you have our heartiest congratulations and we'll forget the sympathy.

(Signed) THE SENIOR CIVILS.

The Junior Civils are stepping out and away from their usual spring quarter surveying routine. Mr. Zelner gave his triangulation classes permission to pick out their own triangles, asking that they be large. Here is a triangle of one of the more ambitious parties—Washburn Park Tower-Minneapolis City Hall Tower-Montgomery Ward Tower. Some others were almost as pretentious, almost approaching the size of those used by the United States Coast and Geodetic Survey. Only the smoke-laden air discourages the choice of larger triangles. Permission has been granted by these buildings to set up the stations upon them. The plane-table parties will plat the well known river flats and also the flats along the river near the American Bridge Company's plant. Mr. Zelner reports the favorable progress of his class of geologists who are taking up the surveying course. Special emphasis is laid on their plane-table work. Many of these men are graduate students who intend making a geological survey of the Badlands.

ELECTRICALS

IT MEETS ALL TRAINS

Probably a large number of the engineers have at some time or other noticed the little old "Toonerville Trolley" parked back of the print shop and have wondered just what it was doing there, where it came from and why it was retained in a more or less secluded existence. The facts are that the old car was one of the first street cars in Minneapolis and used to journey up and down Hennepin Avenue quite regularly, propelled by horses. This old relic is one of the most precious possessions of the Electrical Department and is to be installed in the place of honor in the electrical museum which it is planned to put in the new building.

Speaking of the new building reminds us of the very pleasant news which has just been announced. It is that we are to start moving in about the fifth of May. At that time it is planned to move over the electrical design classes and some of the research work as well as the offices of most of the teaching staff. It is hoped to have all of the laboratory work completed by May 20 in order that all of the students in the department may pitch in and help move some of the laboratory equipment. The senior classes are to be transferred as soon as possible so that the seniors may have some use of the new building before they leave school.

POWER STORAGE BATTERY

Harry F. Greiner has been with the senior class all year completing his senior work and will receive his degree this spring with the rest of the class. Greiner was in the class of 1901 but left school at the end of his junior year and has since been working in the storage battery industry. This year he has been doing some under-graduate research work in connection with the complete overhauling of the auxiliary power storage battery and has made all of the plans for the moving and installation of the battery in the new building.

In overhauling the battery he found that out of 1,300 plates there were only 85 good negative plates and 150 good positive plates. The other plates must be replaced with new ones before the reinstallation of the battery. This battery has given wonderful service to the University, it having been in use for over fifteen years, whereas the usual life of such a battery is from seven to nine years. Much of the credit for the long service of this battery is due to Harry Dixon, the engineer in charge of the University power plant, for the very good care he has taken of it since it was originally installed.

Quite a number of the seniors have been doing special laboratory and under-graduate research work this year. Juran and M. A. Anderson have been working nearly all year on the determination of the amount and distribution of the flux leakage in the magnet of a telephone receiver. They have met with some very difficult problems, as they are attempting to measure power of the order of five ten thousandths of a watt.

Kater and Marcroft put in some good work on the study and measurement of hysteresis effect on different kinds of iron and under different conditions and discovered some very interesting things. Kater is now studying the various uses of electricity and electrical appliances in the medical profession and is compiling a table of the uses.

Mathes has been working on higher powered radio transmitter tubes with a view to building up a transmitting set using these tubes for standard wave transmission work in co-operation with the Bureau of Standards at Washington. He has finally made some preliminary with the Bureau for the purpose of standardizing the apparatus and will continue the work on schedule from the new building after about the 10th of May.

NEW TEST BENCH RECEIVED

The department has just received a complete test bench with all equipment for the testing of auto starters. This bench is of the type sold to garages for this work and will be a big addition to our laboratory equipment in that it will now be possible to make quite exhaustive tests on auto-electric equipment.

MECHANICALS

BORST MARRIES!

Not having enough to worry about, Lyle W. Borst recently joined the ranks of the married men. We had been wondering why he wore such a peculiar smile lately, but now we know. The truth is out, and March 21 was the eventful day. Well, the best of luck to them both. May their journey through life be a pleasant one.

A. S. M. E. MEETING

The American Society of Mechanical Engineers' Student Branch held their regular meeting on April 20th in Room 102, Mechanical Engineering Building. They were honored in having Mr. R. S. Vaile, of the School of Business, give a very interesting and instructive talk on "The Value of Salesmanship in Engineering." This talk proved to be very helpful to all who were fortunate enough to hear it. The next meeting will be the annual election of officers for the coming year. Plans for the coming picnic will also be discussed.

A. S. S. T. MEETING

The Northwest chapter of the American Society for Steel Treating held its regular meeting at the Manufacturers' Club at 8:00 o'clock on April 23. Election of officers was held at this time, and the Engineering department was honored by having one of its faculty chosen as chairman for the coming year. Prof. Priester is the man upon whose able shoulders the leadership of this live society falls. On May 7th, the society went on an inspection trip to the plant of the Mahr Manufacturing Co. A large number of oil burning, heat treating furnaces were in operation. The trip was highly interesting as well as instructive, as the furnaces represented the latest developments along these lines. A large number of members as well as many student non-members attended. These trips are open to anyone interested, and the student body is cordially invited to attend them.

Although primitive water wheels are still used in China and Japan, over 75 per cent of the mills are equipped with modern grinding machinery.

What is believed to be the largest crystal of alum in existence will be exhibited at the coming British empire exhibition in London. It weighs nearly 400 pounds and took four years to grow.

TECHNICALITIES

TACT

It was at the summer house party at the De Witt mansion that Harry, while conversing with Alice, said, "I wonder who is the second prettiest girl here."

A little while later when he was gracefully waltzing in the magnificent dance hall with Marjorie, he said, "I wonder who is the second best dancer here."

The same evening as he was admiring the elaborate evening gowns with Ellen, he said, "I wonder who has the second best looking gown tonight."

But, later when he was comfortably seated beside Lilian in a quiet corner of the veranda, half hidden from the light of the glorious summer moon by the shadows of the lilac bushes, did he say, "I wonder who has the second best kisses here tonight?"

No. He did not. Because he was tactful as well as flattering.—Sun Dodger.

THEY SATISFY

Fatima—Why do cigarets have oriental names?

Murad—Because they have good shapes and thin wrappers.—Moonshine.

"Wha' brand o' bacca are ye smokin', Jock?"

"I dinna ask him."—London Bystander.

Tommy had been playing truant from school, and had spent a long beautiful day fishing. On his way back he met one of his young cronies, who accosted him with the usual question, "Catch anything?"

At this Tommy, in all consciousness of guilt, quickly responded: "Ain't been home yet." — Buffalo Bison.

A REGULAR GIRL

He: "I'd like to propose a little toast."

She: "Nothin' doin', kid; I want a regular meal."—New York Coll. Mercury.

Someone read somewhere about a man who gave the ticket agent at the depot thirty cents for a ticket to Chicago.

"You can't go to Chicago for thirty cents," said the indignant agent.

"Where can I go for thirty cents?" persisted the man. Twenty men, who were waiting in line, told him.—Michigan Gargoyle.

Little Boy—Mother, are there any men angels in Heaven?

Mother—Why, yes, dear, why do you ask?

Little Boy—Because I never saw any with whiskers on.

Mother—Oh, well, dear, the men get

Benda: "Ann told me she worshiped her figure."

Ben-day: "And what did you say?"

Benda: "Nothing. I embraced her religion."—Princeton Tiger.

She: "Getting mighty cold, isn't it?"

He (reflectively): "Winter draws on!"

She: "SIR!"—Wisconsin Octopus.

Wilson: "That girl reminds me of a packing house."

Brothers: "How's that?"

Wilson: "Well, when you get your Armour 'round her she's Swift—and Company."—Texas Ranger.

SOME GET BLACK EYES

Bill: "Say, Jack, how did you get that red on your lip?"

Jack: "That's my tag for parking too long in one place."—California Pelican.

CARFARE

For hours they had been together on her front porch. The moon cast its tender gleam down on the young and handsome couple who sat strangely far apart. He sighed. She sighed. Finally:

"I wish I had money, dear," he said. "I'd travel."

Impulsively, she slipped her hand into his; then, rising swiftly, she sped into the house.

Aghast, he looked at his hand. In his palm lay a nickel.—Columbia Jester.

MR. GREENE CONTRIBUTES

There is something about getting engaged, being arrested, and graduating that makes you want to do a lot of explaining, or to air the methods and means of conquest. It is for none of these reasons, I assure you, that I am willing to unfold some of the action behind the scenes and expose the true light in which some of our best honor students of recent years should be seen.

To begin with, cribbing is an art. Because of intensive study each instructor makes of the subject, yea, and more to be feared, the first-hand knowledge of the art he had when he was but a mental foundling, the student of today who successfully perpetrates his cunning upon the time-warned vendors of cerebral accumulation should not only receive his degree, with twice as many ribbons on it as the rest, but he should be publicly lauded for his cleverness.

Radio has found its usefulness apparent in every conceivable phase of life. At some time during the day nearly every subject of thought is touched upon in one place or another and broadcast for listening ears to hear. What a simple matter, in the midst of such conveniences, to more carefully control the nature of the matter broadcast, and to more accurately adjust the time of the broadcasting. Critics of collegiate attire have discoursed at length upon the tendency of student types to allow the hair unusual growth around the ears and above the back collar-button, but little have they stopped to consider that to conceal a simple receiving set requires more space than the cranial decorations of a few years ago would permit. Ah, I have given the secret away, what more is necessary? Only a student not required to take examinations in the course, who can hurry away when the questions have been assigned, a nearby sending set of no great power.

One cannot, however, rely on any method to answer for all conditions, and the variety of attack is as essential as the attack itself. One can recall the time when questions were given out one by one, where the subject covered wide territory, and where not even a radio set could pass inspection. During the past few years I doubt if there is a reader who has not been disturbed by the harsh pounding of the steam pipes. In the midst of attempted concentration, when the reward of failure was an "F" you have inwardly cursed the noise that was proving your undoing. But had you but been aware, these poundings carried unusual significance, and in simple code conveyed to waiting ears the information so much desired. Crude and elemental, you say? As stated, yes; but what more simple than a furnace thus designed to give forth the poundings to the peculiarities of the fuel—and a fireman properly trained to throw the text-books in? We shed a tear for the text-books thus destroyed, but then we can soon rejoice in the dividends on the new ones purchased!

Thus we see the rising young engineers getting started on spectacular careers because of the very brains behind them. It would not be fair in passing to omit at least mere mention of the lesser schemes used by Tau Beta Pi at large and by our local scintillators in particular. A single box of cough-drops, the possibilities of the split-hair pen and digestible ink would be obvious enough. The large flat sides and ample edges of peppermints carry space enough, and once these were devoured, what council could convict? Gum, lollipops, cigarets—anything that doesn't make one very sick finds favor in the sight of the brainless one. But to the real engineer, the pioneer of ingenuity and creative instinct, we give the honors and the spoils—and as for the instructors, we hope they don't mind.

ARABS WELL RECEIVED IN ST. CLOUD

"Enthusiastic Audience Witnesses "Riquiqui"

Unusually artistic scenery, attractive costumes, unique music most of which was a pleasing departure from conventional musical comedy melodies, and clever lines, albeit they were a bit too ornate for the average run of audiences, combined to make "Riquiqui," a three-act play written by Glanville Smith, St. Cloud, an unqualified success when it was presented Saturday night to a sophisticated and expectant audience at the Sherman Theatre.

The play was presented by the Arabs, a dramatic organization of men students in the technical colleges of the University of Minnesota. When it is reflected that the play, the music, the scenery, the costumes, the orchestra and orchestrations, and in fact everything from the coaching to the programs was the work of this organization, its success is the more significant.

Motivation Good

Perhaps the lines of the various acts did at times assume levels too elevated for the average appreciation; they were at least scientifically accurate and cleverly done. This motivation was clear and the story, fragmentary as it was, moved through to its successful conclusion without interruption. The music, several numbers of which undoubtedly will find their way into public favor, was symphonic at times, and changed with logical transition the next moment to lively allegros full of harmony.

It was a pleasing presentation, one of the outstanding theatrical events of the year for St. Cloud. At its conclusion, Glanville Smith, son of W. W. Smith of St. Cloud, was called to the front where he was given a rousing ovation.

Perhaps the most memorable feature of the play was the artistic and gorgeously appointed scenery. The first act was planned aboard a ship, while the second and third called for underwater effects. Of the three shifts, the second was the most beautiful, spun as it was around the traditionally cosmic web of mermaids and sea-bottom splendors. It was here, surrounded by the iridescence of coral reefs and subterranean vegetation, that King Davy, "Monarch of the Seven Seas," held his royal and picturesque court, unwelcome visitors to which were the five idealists in search of Utopia.

Roles Well Taken

Considering their unalterable masculine attributes, a number of the members of the Arabs made charming mermaids indeed, acquitting their feminine roles with an ease that at times almost was convincing.

In the midst of a sickening romance and a sordid round of events, such as have unhappily, for the most part, made up the modern stage production, "Riquiqui" was a pleasing and refreshing departure. The acting showed careful coaching and meticulous exactitude, and the voices fitted well to their parts. To go into any elaboration of individual roles would be at once superfluous and misleading, as each member of the cast, from the pulchritudinous mermaids to Riquiqui, who in lieu of other accomplishments boasted a "pleasing smile," carried their parts with an air of confidence.

It was regrettable that more of St. Cloud's people were not on hand to witness an event delightful and unusual in its originality and splendid technic."

THE GEOLOGIST

The subject of geology 's the theme of which I speak.
It means a knowledge of the earth to those who know their
Greek.
A knowledge of the earth, you'll say, does not mean much
to you,
But I'll proceed to show you what geology can do.

The man who plies this calling has an interesting trade,
And tells us all about the way in which the earth is made;
He believes in evolution, and he doesn't quite agree
With William Jennings Bryan's views on Adam's family
tree.

He tells of curious animals that lived in years gone by—
Of anthropoids called trilobites, and reptiles that could fly,
Of dinosaurs and mastodons that roamed the forest ways,
And how the women bobbed their hair in prehistoric days.

Some people think geologists are queer, mysterious "nuts,"
Who spend their lives in quarries or exploring railroad cuts.
Or poring over fossils that had left the world forlorn
Some twenty million years or so before King "Tut" was
born.

But to the world of business he no longer is a joke,
And many of his calling are now anything but broke.
Without his aid 'twould cost you more for gasoline and oil;
He shows just where petroleum hides, by scientific toil.

They use him in the mining camp when they have lost the
vein,
And put it up to him to go and find the thing again;
He maps the rock formations and he climbs until he's sore,
But when he's through, the tunnel shows a solid face of ore.

He helps the military men, emergencies to meet—
As how to dig dry trenches to preserve the doughboy's feet,
And where his gun emplacements may be found of solid
rock;
The kind of shells he ought to use to get the greatest shock
(Though very few observers who were close enough to tell
Can describe how different kinds of ground effect a burst-
ing shell.)

And when the highway engineer is seized with painful fits,
Because the roadbed he has built is being cut to bits,
He calls for the geologist and pays him many "bucks"
To find a rock that can withstand the shock of heavy trucks.

When the cry for water calls him to do his level best
In the arid sagebrush valleys of our great and growing
west,
By mapping all the different rocks that on the mountain
show,
He tells the rancher where to bore to get artesian flow.

But mining litigation's where he "knocks 'em for a row,"
And shows that he is human when it comes to making
"dough";
For mining laws are queer and a geologist of fame
Can prove a vein dips anywhere, if he has got a name.

But in spite of human failings, and, like all he has a few,
He's helped to light the torch of truth so man may clearer
view
The kind of world he dwells upon, and out of which he
rose,
Though fundamentalists may rave, he proves the facts he
knows. —By D. C. Livingstone.

UNIVERSITY RECEIVES GIFT OF CRUDE ORE

For their studies in the treatment of ores mining students at Minnesota have received a gift of three tons of typical copper ore in the shape in which it goes to the concentrators. Two tons were given by the Anaconda Copper Co., of Butte, and one ton by the Chief Consolidated Mining Co., of Eureka, Utah.

PLANS ARE MADE FOR NEW FOUNDRY

(Continued from Page 12)

One corner of the shop has been walled away from the main foundry by a 4 foot wall. This space has been set aside for the production of non-ferrous castings, and because a finer molding sand usually is used for this class of work than for grey iron castings the two departments should be separated. Unlike the exasperatingly narrow tubs in the non-ferrous department of the present foundry, the tubs provided for in the foundry of our dreams will be 3 feet wide so that one will be able to get a shovel into them. In the non-ferrous foundry of the new shop there assuredly should be an electric furnace instead of the crucible type which does not possess the flexibility of the former. The repel-arc type of electric furnace has been selected because it is simple in its operation, and does not require any control apparatus. An extra furnace bowl should be provided for

With one exception, no school visited had a charging floor large enough. The exception is at the new foundry of the University of Michigan where one of desirable proportions has been provided. Nevertheless, it is apparent what opportunity most of the members of a class of 60 would have when packed like sardines with coke, pig iron, scrap iron, blower and blower motor into a charging floor space of 10 by 20 feet, to hear an explanation of the method of charging a cupola. The charging floor at the University of Michigan foundry is 23 by 60 feet, while the one provided for in the accompanying plans is 22 feet wide by 80 feet long. There then is no question about accommodating a large class on a charging floor of this size. A charging platform should be a mezzanine floor so that those engaged at work on it will be within easy communication of those overseeing the work below. Furthermore, such a feature lends an open, pleasing appearance to the shop; not to mention the additional comfort given to those who are charging the cupola while it is in blast. A railing wall about 4 feet high entirely around three sides is necessary to prevent material from being accidentally pushed over the edge and dropped below. Provisions have been made for the installation of an electrically operated elevator for bringing the raw stocks from the basement to the charging floor, if, indeed, storage space in a basement for these materials ever would be needed with a platform of this size. A set of floor scales has been considered desirable for weighing the charges of metal on the charging platform. An 18 inch gauge floor-level track has been run around the four sides of the platform to connect with the elevator, scales and the cupola. This adjunct will enable the charging buggies to be loaded and weighed, and then pushed to one side of the cupola. After the charging has started the empties can be moved to the other side out of the way, and a loaded buggy drawn up to the charging door, where its contents would be thrown into the cupola. A landing platform at the level of the charging floor and extending outward from it will enable material to be taken directly by the crane from the molding floor to the platform should such a necessity ever arise.

The cupola has been set at the center of the shop to facilitate the distribution of the molten metal to what is in effect two separate foundries, and, at the same time, make it possible to extend the charging platform out far enough to give the required floor space up there. Ample room has been left encircling the cupola at the molding floor level to enable a large class to gather around it when an inspection of the furnace is being made. Furthermore, elbow room will be provided for those who are assigned to the work of cleaning out, repairing or operating. A circular steel staircase extending from the floor back of the cupola to the charging floor will permit quick ascent independent of the elevator. On the same floor, and near the cupola, has been placed the blower room. This arrangement will keep the blower off the charging platform where it would be more or less in the way.

Under the mezzanine charging platform there has been provided a core room large enough to accommodate ten pupils. A larger one was not planned because in a class of 60 it is thought that, if the Department of Mechanical Engineering continues to make the same class of castings as it now requires, a ratio of one student making cores to six at molding work will be high enough. A greater proportion would soon cause an overproduction of cores. Space has been set aside for a large core oven open at both ends, and with a track running from the core room through it to the molding room, to facilitate the handling of large cores. However, this oven need not be installed until requirements demand it. Through the core room and over the elevator a part of the 18 inch industrial track system extends to both sides of the shop. This arrangement will make it possible to run a truck to either side for the collection of castings or refuse which then can be taken directly to the cleaning room in the basement. The walls of the core room adjacent to the molding floors should be made of Fenestra sash so that the dust from the foundry can be kept out, and plenty of daylight provided.

It hardly seems necessary to invite attention to the room set aside for the systematic storage of patterns, but if a course in foundry practice is properly taught to a class of 60 pupils there will be need for several hundred patterns. Obviously all of these cannot be in use at one time. Therefore, it becomes necessary to store away the bulk of them so that they will be removed from the abuse to which they inevitably would be subjected if left scattered throughout the molding rooms, and, also, indexed to enable their ready location when they are needed.

In the new building the machine shop will be located below the foundry, and below this shop there will be available a basement equal in area to the floor space of either shop. On one entire side a locker and wash room 19 feet wide has been located. There is space in this room for 112 lockers and 96 wash basins, and, if the demands ever require it, 36 more lockers can be placed in the hallway. This generous supply of 96 wash basins is in decided contrast to the present shops where the classes from four shop courses have at their disposal 13 wash basins. The lockers and wash basins have been set perpendicular to the inside wall to permit daylight from the windows to pass in between the rows. Also, five entrances have been made in the plans to give ready access to the room. Each locker has been allotted a space 2 feet in width by 1½ feet deep. The pupils who are pursuing the course in forge and foundry practice will appreciate the installation of shower baths to accommodate ten at a time, and, if need be, more could be installed by removing some of the lockers to the broad hallway at the end of the room. If a pupil does not make use of the baths, it is not that he has insufficient reason, because after having run off a heat, or shaken out the molds, or cut over the sand in a foundry he has accumulated enough grime to make a bath desirable if not necessary. If those who do not consider the showers necessary were teaching the course in foundry practice they would be burdened with answering incessantly the question as to why no bathing facilities are provided where they are most in need. Between the locker room and the storage room on the other side, a hallway 8 feet wide has been set aside to facilitate the transfer of material and equipment from one set of shops to the other set.

A space 32 feet wide, and running the full length of the remaining side of the basement, has been devoted to storage—one-half to the machine shop, and the other half to the foundry. At the center a delivery or receiving door has been provided to handle any supplies brought to the shops by trucks coming into a court which will lie between the new electrical engineering building and the mechanical engineering building to be built to the north of the former.

According to the plans, the foundry will utilize most of its basement space for the cleaning of castings. By placing the usual appliances, such as tumblers, sand blast, grinders, and chipping bench, in the basement two advantages accrue. One is that this arrangement will leave more space available up in the foundry, and the other is that the noise and dust, that accompany the operation, will be removed from the foundry. Most state laws require that a cleaning room of a foundry be separated from the molding room either by placing it in a separate building or completely walling it away from the molding room. The cleaning room of the new foundry, if arranged as suggested, certainly will meet the requirement of being removed from the molding room since there will be two floors between it and the foundry above. The flask storage space, 10 feet wide by practically 50 feet long, will make it possible to store the extra flasks on the inside out of the weather.

It is regretted that the space limited to this article did not permit the insertion and discussion of plans for the requirements of an ideal school foundry adapted to the needs of a class of sixty pupils. These plans would have served to indicate further the severe limitations imposed by the University Plan on the prospective foundry of the Department of Mechanical Engineering.

DOWN AROUND MT. OLYMPUS

(Continued from Page 16)

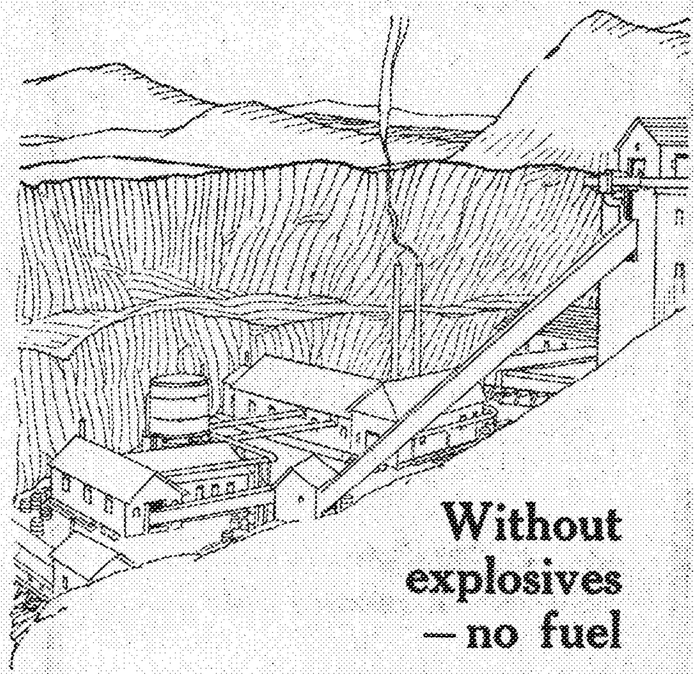
"The difficulties of mining here in Cyprus are more than ordinary. The natives have been shepherds and farmers for hundreds of years and had no knowledge of mining. It has been a slow process for the past ten years training them for underground work. I am told that when they first started to work here, they put a ladder up to an olive tree, had the prospective miners climb the ladder and climb around in the tree for days at a time before they gained sufficient courage to work in a shaft."

Due to the oxidation of the sulphur in the ore, the heat in the mine workings is very high and the ventilation was poor. Mr. Jackson has solved this problem by the proper installation of mine fans and has succeeded in doubling the output of the mines and increasing the tonnage per man by 33 per cent. He is employing at the present time about 600 men, of whom 65 per cent are Greeks and the balance Turks.

Although Mr. Jackson's work as superintendent has been increased by a serious fire in the mine and an accident in the shaft, he has some time for sightseeing. He says, "The island itself is extremely interesting and has figured prominently in history. It has always been governed by some great power, the Persians, Phoenicians, Egyptians, Greeks, Romans, Turks, and now by England.

"One may travel in Cyprus on foot, by donkey, camel, carriage or automobile. The 'tin Lizzie' of Henry Ford is frequently seen and is the most numerous of the auto breed here.

"The summers are hot, much like those of Arizona and New Mexico, and the English residents nearly all go to Mt. Troodos for the summer. Mt. Troodos is the Mt. Olympus of Greek mythology. I have a Fiat car and a summer camp there for my family."



RAILROADS ARE OVER-CAPITALIZED

(Continued from Page 7)

added because figures on the total miles of track are not obtainable before the first reports of the Interstate Commerce Commission.

Capital Is Duplicated

The figures on total capitalization are for the total amount of stocks and bonds outstanding and they include all intercorporate holdings of the railway companies. Since many of these holdings are held for the purpose of control of subsidiary companies and are pledged as security for new capital issues, there is considerable duplication of capital and these figures do not reflect the time value of the properties. Again some of the holdings of the issues of other companies are held for investment and are not so pledged, so that all stocks and bonds held by the railways should not be deducted. Since these classes of holdings are not separated in the reports, we can only deduct all intercorporate ownership and the remainder will give the amount of capital issues held by the public. In 1921, 23.4 per cent ($5,208,759,799) out of $22,291,635,792 was so held, reducing the capital issued and held by the public to $17,082,875,993.

The apparent decrease in stock and total capitalization in 1888 as shown in the diagram is probably due to the different sources from which the figures were obtained. Previous to 1888, the best source of railway statistics is Poor's Manual, an unofficial publication but compiled with great care. Beginning with the report of 1888, the source used is Statistical Reports of the Interstate Commerce Commission. The earlier reports are as good as Poor's Reports, but since the uniform system of counting has been installed, the reports have become as accurate as it is possible to make them.

The figures from which the curves were constructed were obtained from the following sources:

1871 to 1887—Poor's Manual of Railroads.

1888 to 1921—Statistical Reports of the Interstate Commerce Commission.

ST. PAUL BUILDS A NEW BRIDGE

(Continued from Page 9)

used mainly on the center arch, is about 880 tons.

Brick paving will be used on the roadway, which is 56 feet wide. About 8,030 square yards of brick will be laid. The two sidewalks are to be each 10 feet wide.

A double street car track will occupy about 15 feet of the available roadway, leaving about 20 feet of vehicular traffic space on either side.

The poles used to suspend the street lights are of ornamental iron, and will be spaced about 97 feet on centers. These same poles will also serve to hold the trolley cables. Two lamps on each pole will provide ample illumination. Lights will also be placed on the substructure for the guidance of river traffic.

In view of beauty, permanence and utility, St. Paul will have a bridge of which she can well be proud.

The writer wishes to thank the firm of Toltz, King & Day for the assistance accorded in the preparation of this article.

No radio broadcasting stations have as yet been established in Spain.

MINING ALUMNI ACHIEVE SUCCESS

(Continued from Page 8)

engineer, from 1919 to 1922, when he was moved to the Research Laboratory of the same company at Schenectady, N. Y., as a metallurgist. He has remained there since that time. During the war Hoyt served as a consulting metallurgist of the U. S. Bureau of Mines, working in co-operation with the National Research Council for the war minerals investigation.

Allan B. Calhoun received the degree of Mining Engineer in 1905. He obtained his first job at Butte, Mont., working as a miner and timberman at the Gray Mine. He then became an assayer, surveyor and shift boss at the Cornucopia Mine, in Oregon. In 1907 he went to Rossland, British Columbia, as acting superintendent of the White Bear Mining Co., Ltd. He next worked at the Center Star Mine, at the same city, as engineer. In 1908 he was made engineer for the Consolidated Mining & Smelting Co., where he stayed till 1911. He served for a time as superintendent for the Motherlode Sheep Creek Mining Co., Sheep Creek, B. C., but moved to Spanish Honduras as consulting engineer in 1912. The next year found him back again in British Columbia as engineer of the British Columbia Copper Co., Princeton. The following year he became superintendent for the Arabian Consolidated Mines, 'Frisco, then moved to Santa Barbara, Chihuahua, Mexico, as superintendent of the El Rayo Mining & Development Co. Soon after he became efficiency engineer for the Old Dominion Mining & Smelting Co., at Globe, Ariz. In 1917 he became mine superintendent for the Burma Corporation, Ltd., Burma, India. He was later promoted to the position of mine manager for the same company, where he has been employed to date.

Oliver J. Egleston was graduated with the class of 1900, receiving the degree of Mining Engineer. For two years following his graduation he worked as a draftsman for George K. Fischer, Salt Lake City, Utah. In 1902 he was made constructing engineer for the U. S. Smelting, Refining & Mining Co., which position he held for eleven years. At the end of that time he was made assistant consulting engineer for the same company. Three years later he was again promoted to the position of engineer, and in 1917 became chief engineer. Egleston is at present manager of the Mammoth Plants for the U. S. Smelting, Refining & Mining Co., at Kennett, Cal., where he has been working since 1919.

Roy C. Grant was given his degree, that of Mining Engineer, in 1909. For a time he was employed as a chemist and assayer with the Pacific Assay Co. of Seattle, Wash. From Seattle he moved to Hollis, Alaska, as a millman at the Dunton Mine and Mill. His next work was examining mining prospects in Honduras, C. A. He returned to the United States for a short time, but soon moved to Colombia, S. A., on placer examinations for the New York Mining Co. From there he went to the Belgian Congo as mining engineer with the Societe Internationale Miniere du Congo. During the war he served in the Intelligence Department of the U. S. N. in Spain. At the close of the war he moved to Inmachuk, Alaska, as assistant manager for the Fairhaven Water & Mining Co. Two years later he went to Africa as mining engineer with the Companhia de Diamantes de Angola, and then South West Africa Co., Ltd.

STADIUM GOES UP ON SCHEDULE

(Continued from Page 6)

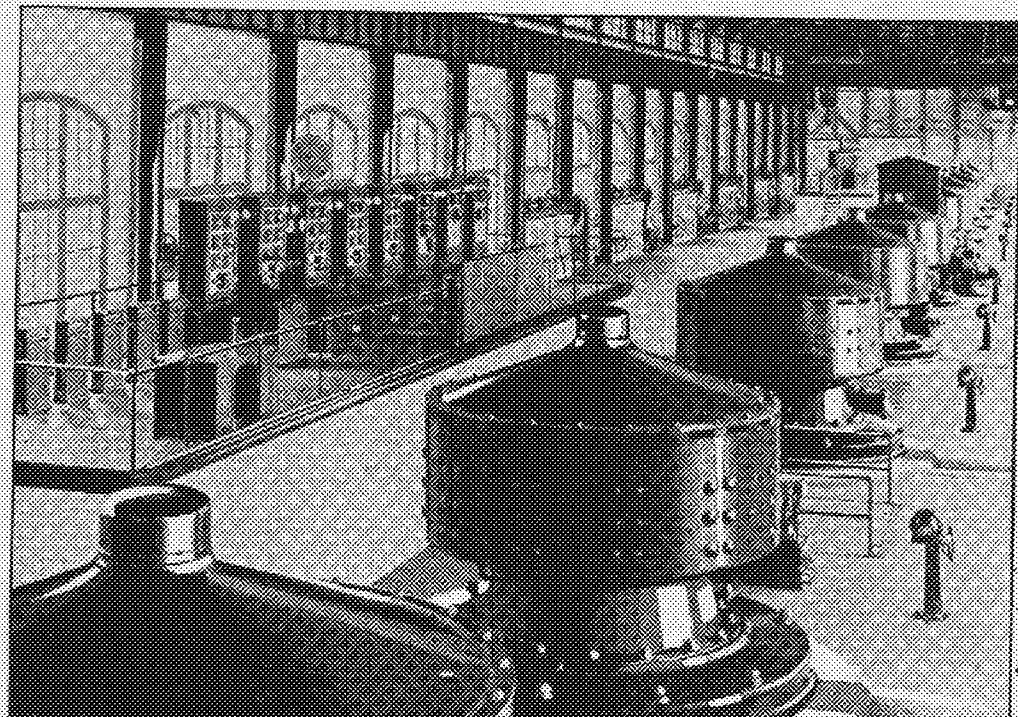
conduct experiments in order to determine a combination of soils that would give the best results under the conditions found at Minnesota. The importance of a good playing field and sod cannot be over-estimated or given too much attention. The sod must be firm and durable and give a good, reliable foothold. It should also be of such a nature as not to get muddy whenever subjected to a rain. It must be well drained, but at the same time it must be capable of holding moisture so that a minimum amount of sprinkling will be called for during dry weather. Here it was found that the under soil was a sand that was capable of absorbing moisture and furnishing a means of drainage that would take care of an almost unlimited amount of excess rain water, and so it was not necessary to put in any elaborate system of drain tile such as was done at California and Michigan.

Several types and combinations of top soils were subjected to "rains" in the laboratory and the resulting conditions were noted. After studying the results of these tests it was decided to construct the field in the following manner: first a twelve-inch layer of clay, then four inches of black loam, and then two inches of a sandy loam. This combination was subjected to a rainfall of three inches in a period of eight hours and the indications were that the field was still in good condition for playing. According to the records of the weather bureau, the worst rain that we have had during the football seasons of the past fifteen or twenty years was a rainfall of 2.89 inches in twenty-four hours, a rain that the field will be able to stand without any trouble. The layers of soil function in somewhat the following manner: the sandy top soil prevents the field from becoming muddy, the loam furnishes nourishment to the sod, and the clay will hold sufficient moisture to tide the grass over dry spells during the summer.

The nature of the sod is of importance and has been given its share of attention. It has been found that a creeping bent is one of the best grasses for a football sod, but at this time of the year it is very difficult to obtain sod with which to start the green, and the seed is not only hard to obtain but at best is very unreliable. Therefore it has been decided to seed fescue, red-top, and blue-grass as soon as possible, and then introduce bent by "plugging" later in the season.

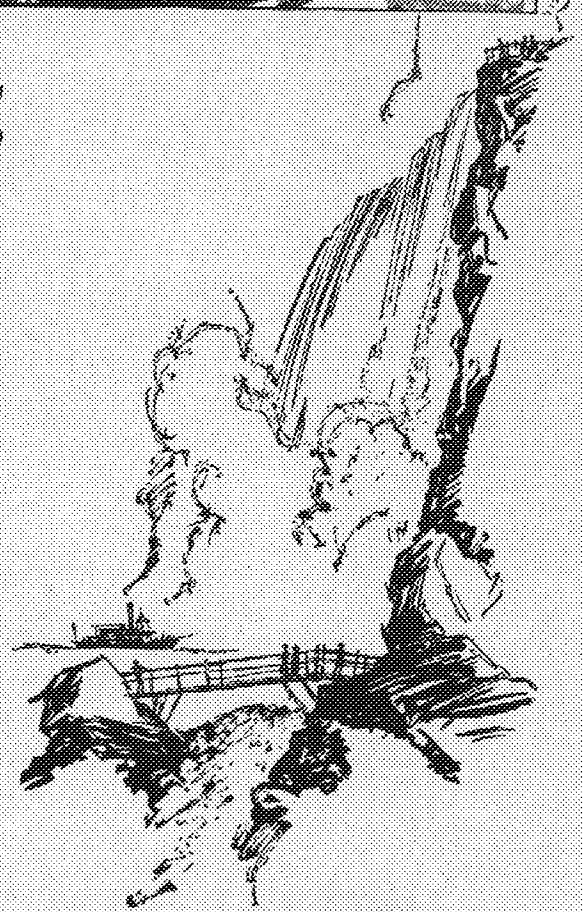
The contract calls for the completion of the stadium about November 1st, and the general contractors, James Leck Company of Minneapolis, are keeping up to a schedule which will enable them to complete it within the required time. So if everything goes along as expected, Minnesota will this coming fall dedicate a "Memorial Stadium—built by the gifts of the people in memory of the sons and daughters of the University of Minnesota who served in the wars of the Republic"; and we may be sure it will be a structure of which we will be justly proud.

On account of the increased use of electricity for illumination, many incandescent gas mantle factories in the United States have turned their attention to other forms of production.



Harnessing Niagara Falls for the First Time

What Engineering Owes to Faith



THE pioneer harnessing of Niagara Falls in 1892, like all great engineering feats, was the result of the co-operation of many able and constructive minds. There were no "older engineers" on this work, with younger assistants, as is now common, because there were no "older" engineers then. All of them were young men in a young business, optimistic, enthusiastic and willing to take long chances.

The original Niagara installation represented progress based largely on faith because there were many features of construction proposed at that time which Westinghouse Engineers refused to accept, and which time has shown to be utterly impracticable.

Thus, in effecting a compromise, the three fundamental features of *heating*, *insulation* and *regulation* of the 25-cycle machines as built, were vastly different from the original designs. Time verified their judgment, the ten original generators operating successfully for more than a quarter of a century.

Looking back, it is gratifying that those young men served engineering so courageously, because truly it was an undertaking that taxed their faith to the limit.

Westinghouse

WESTINGHOUSE ELECTRIC

ACHIEVEMENT & OPPORTUNITY

HENRY CAVENDISH
1731-1810
English chemist and physicist, of whom Biot said, "He was the richest of the learned and the most learned of the rich." His last great achievement was his famous experiment to determine the density of the earth.

He first made water from gases

Henry Cavendish, an eccentric millionaire recluse, who devoted his life to research, was the discoverer of the H and the O in H_2O. In fact he first told the Royal Society of the existence of hydrogen.

He found what water was by making it himself, and so became one of the first of the synthetic chemists.

Cavendish concluded that the atmosphere contained elements then unknown. His conclusion has been verified by the discovery of argon and other gases.

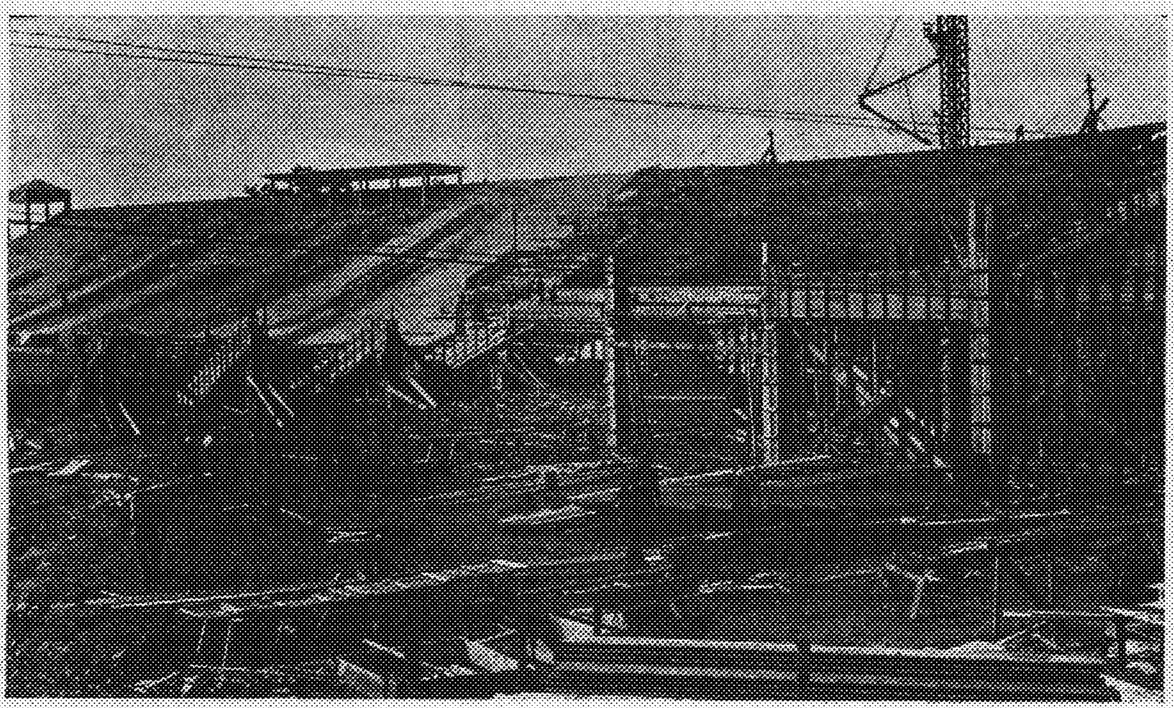
The Research Laboratories of the General Electric Company have found a use for argon in developing lamps hundreds of times brighter than the guttering candles which lighted Cavendish's laboratory.

In this age of electricity the General Electric Company has blazed the trail of electrical progress. You will find its monogram on the giant generators used by lighting companies; and even on the lamps and little motors that mean so much in the home. It is a symbol of useful service.

GENERAL ELECTRIC

MINNESOTA TECHNO-LOG

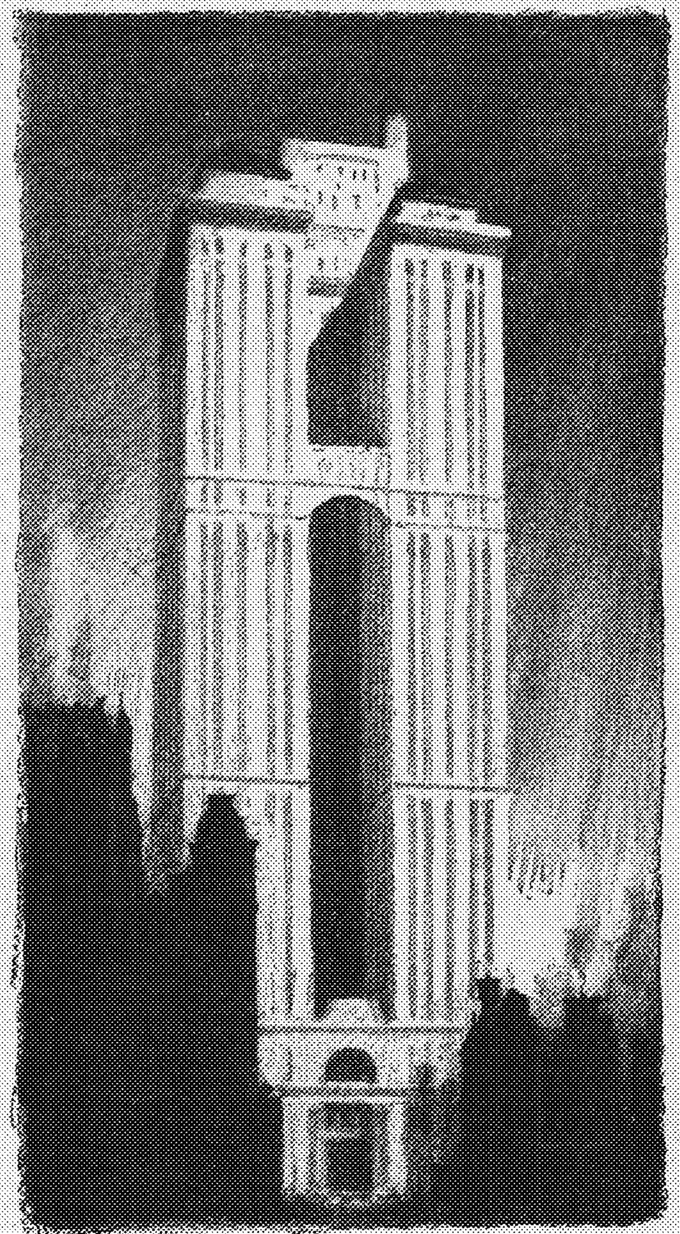
VOL. IV. NO. 8 JUNE 1924



Published Monthly During the School Year by the Students of the College of Engineering and Architecture, School of Chemistry and School of Mines of the University of Minnesota

MEMBER OF THE ENGINEERING COLLEGE MAGAZINES ASSOCIATED

ALUMNI EDITION



The Magnolia Petroleum Building, Dallas, Texas
ALFRED C. BOSSOM, Architect

Drawn by Hugh Ferriss

© O. E. Co.

"Sheer Height"

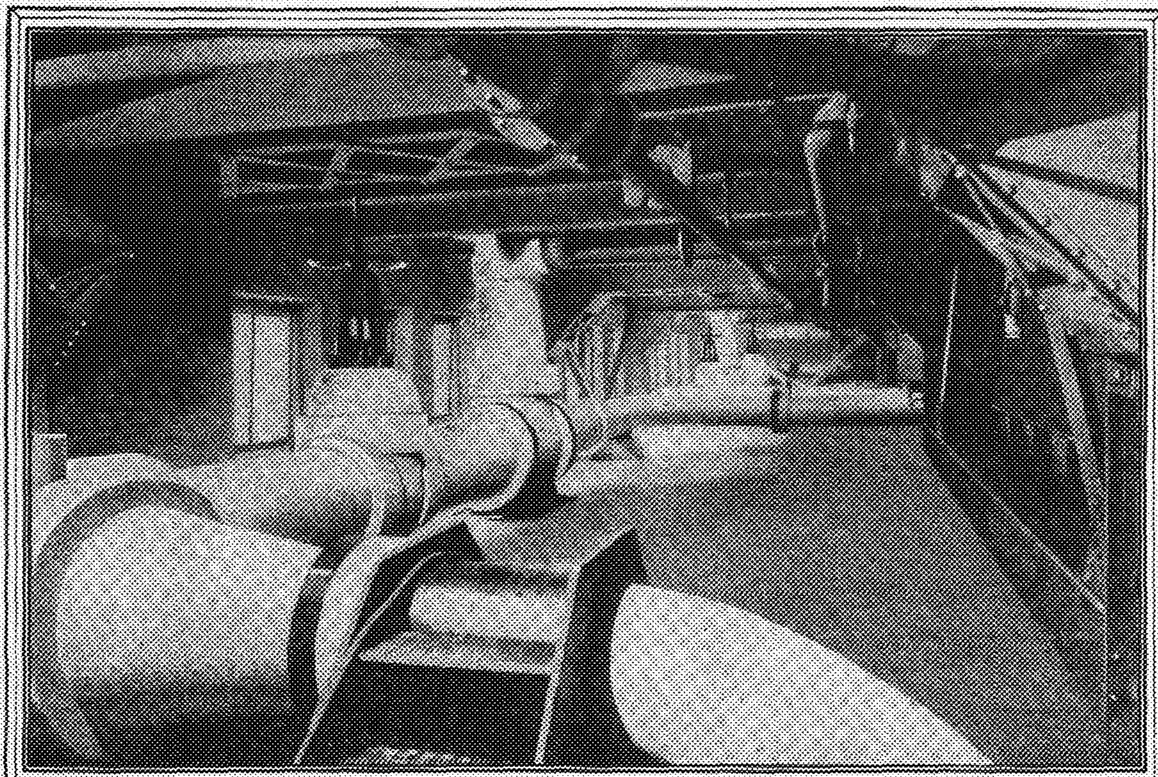
THE American business building represents a distinct and national architectural style when its design frankly emphasizes its sheer height and outwardly expresses the inner facts of its construction.

The tall buildings which stand as monuments throughout the country to the vision of our architects and the skill of our engineers have, in the gigantic profiles which they rear against the sky, the true American spirit of aspiration and progress toward even greater achievements.

Certainly modern invention—modern engineering skill and organization, will prove more than equal to the demands of the architecture of the future.

OTIS ELEVATOR COMPANY

Offices in all Principal Cities of the World



MANY CRANE VALVES, FITTINGS AND PIPE BENDS ARE USED IN THE RIVER ROUGE POWER PLANT OF FORD MOTOR COMPANY

VALVES AND FITTINGS FOR ANY SERVICE

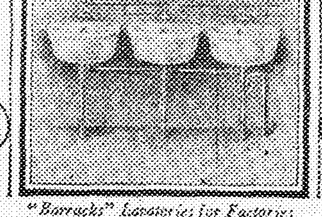
Much unusual equipment is used in the River Rouge power plant, where powdered coal mixed with blast furnace gas, is burned under the largest boilers in the world. For important piping in this plant, however, Crane valves and fittings of standardized design, satisfy the most exacting requirements. Regular Crane piping equipment, built to exacting standards, meets all but the most unusual needs. Special equipment, as pipe bends or valves and fittings of uncommon dimensions can be supplied in all sizes, for any working pressure.

CRANE

GENERAL OFFICES: CRANE BUILDING, 836 S. MICHIGAN AVE., CHICAGO
CRANE LIMITED, 386 BEAVER HALL SQUARE, MONTREAL, QUEBEC

Branches and Sales Offices in One Hundred and Forty-five Cities
National Exhibit Rooms: Chicago, New York, Atlantic City, San Francisco and Montreal
Works: Chicago, Bridgeport, Birmingham, Chattanooga, Trenton and Montreal

CRANE EXPORT CORPORATION: NEW YORK, SAN FRANCISCO
CRANE-BENNETT, Ltd., LONDON
Cie CRANE, PARIS



"Barracks" Lavatories for Factories

MINNESOTA TECHNO-LOG

University of Minnesota

VOLUME IV — JUNE, 1924 — NUMBER 8

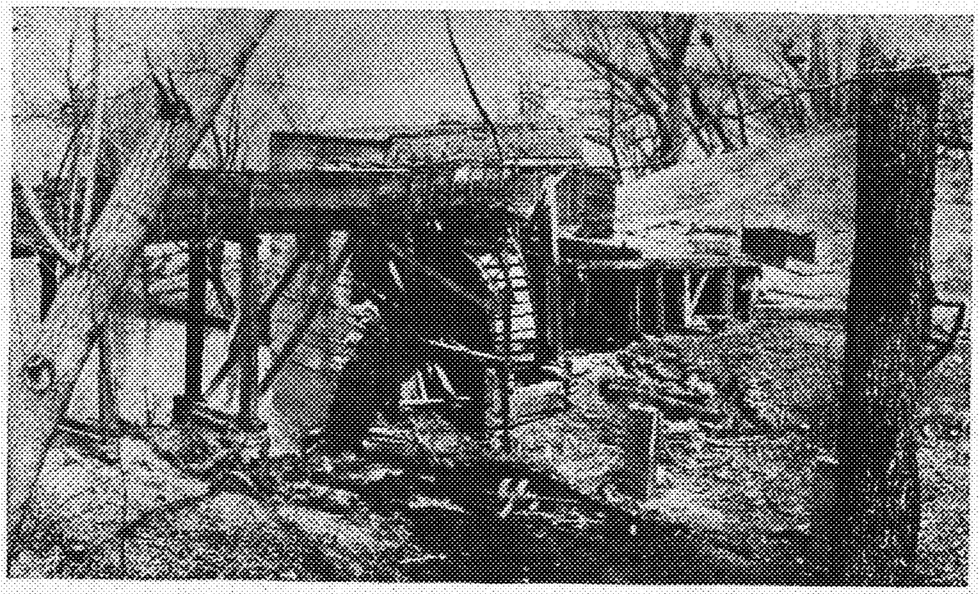
WILSON DAM AT MUSCLE SHOALS

Will Be the Largest Structure of Masonry in the World---
Work to Be Completed by June, 1925

By Arthur P. Peterson, E.E. '18

OVER one hundred years ago the old mill shown on this page was built on the south shore of the Tennessee River just about a half mile above the site of the Wilson Dam. Almost hidden from view in a narrow ravine it is still grinding corn with its six horsepower, but soon the water of the river will be stopped by the giant dam and this old landmark will be no more.

From 6 H. P. to 640,000 H. P. is quite a change. Not only will the complete powerhouse at Muscle Shoals generate that tremendous amount of energy, but the huge lock will remove the barriers to navigation that have existed in this section of the river.

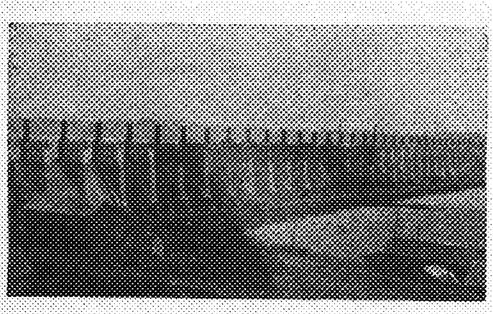


The Old Mill That Is Still Grinding Corn

Wilson Dam is divided into three parts, each having a different purpose. The lock is on the north shore of the river, the Spillway Dam stretches across three-quarters of the river bed at this point, and the powerhouse which occupies the remainder of the river bed adjacent to the south shore. A concrete arch bridge will span the spillway and the powerhouse sections, and this highway will be carried to the north shore over a bascule bridge spanning the lock. The total length from bank to bank is approximately 4,600 feet.

When completed it will be the largest structure of masonry in the world, containing 1,291,385 cubic yards. Its nearest competitor is the Assuan, Egypt, with 1,179,000 cubic yards. Keokuk Dam on the Mississippi comes fifth with 540,000 cubic yards.

Of the total area of 40,570 square miles drained by the Tennessee river, 30,514 square miles are located above Wilson Dam.



The Lock

There are two lifts of 45½ feet

an available length of lock chambers of 300 feet, width 60 feet and depth 7½ feet.

The construction of the lock necessitated the removal of 355,851 cubic yards of earth and 230,300 cubic yards of rock. The lock will require 76,600 cubic yards of concrete of which about a third was in place April 1, 1924.

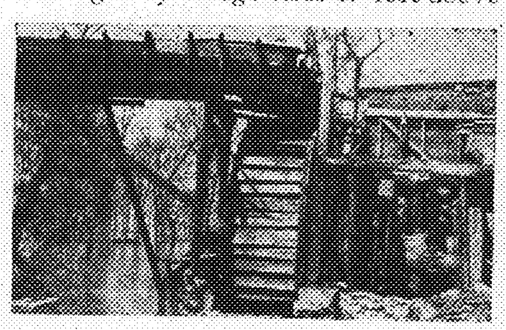
The Dam

The dam proper is in two sections, the non-overflow and spillway sections. The former is in two parts, 180 feet being between the river wall of the lock and the spillway section, and 230 feet between the spillway section and the powerhouse. The longer section, which is known as the sluice section, contains 13 sluices, 9 feet in diameter, with centers at an elevation of 410½ feet.

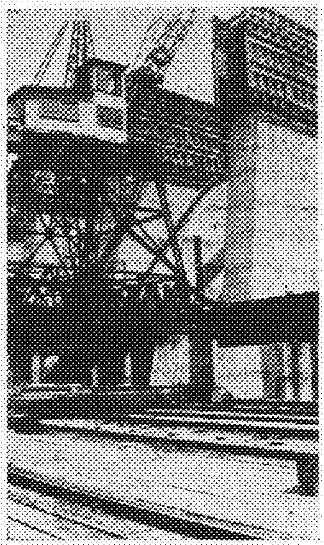
Controlling gates regulate the discharge of excess water over the crest of the spillway section in order to maintain the level of the pool above the dam at an elevation of 501 feet. This pool extends upstream a distance of 14.7 miles to the site of Dam No. 3 and will have a surface area of 14,087 acres.

The spillway section is 2,660 feet long, with 58 crest gates which are 18 feet by 38 feet. Each one of these gates weighs 33 tons and discharges about 12,175 cubic feet of water per second.

The river bed (rock surface) has an elevation of 404 feet at this point and the spillway crest, 483 feet. The floor of the highway bridge rises 37 feet above the crest.



The maximum head of water on the wheels will be 96 feet with a minimum of 68 feet. The dam is 101 feet wide on



Placing the Upper Forms

and the apron 59 feet.

Before the dam could become a reality 6,997 lineal feet of coffer dams were required and all of this preliminary work is complete; 145,000 cubic yards of rock had to be taken from the river bed. The finished dam will require 703,285 cubic yards, of which some 500,000 have already been poured.

The Powerhouse

The powerhouse section comprises a dam and the building housing the machinery, the dam being a continuation of the spillway section. Three large penstocks which are moulded in concrete pierce the dam and carry the water to each turbine, bringing the total number of penstocks to 54.

On the high bluff overlooking the powerhouse will be located the distribution equipment and transformers. A railway is being built terminating under the cranes of the powerhouse.

The powerhouse is protected from ice and other trash by a finder extending its whole length of 1,184 feet. It will be 71 feet wide, with a height of 60 feet above the main floor. Two cranes of 150 tons capacity will be installed.

There will be 18 generating units and two exciting units with a total capacity of 640,000 H. P. instead of 624,000 H. P. as originally proposed. The turbines will travel at a speed of 100 r. p. m. and at full load will discharge 3,450 cubic feet of water per second. The turbine rotor will have a diameter of 23½ feet and a shaft of 28 inches in diameter. The contemplated voltage of the generators is 12,000. The three penstocks feeding the water to each turbine are 12 feet 4 inches by 15 feet 10 inches. The total weight of the revolving parts is 484,700 lbs.

Over two-thirds of the total rock excavation of 307,369 cubic yards necessary has been completed and over one-half of the 511,500 cubic yards of concrete which will ultimately be required has been laid.

Construction Data

Twenty-five hundred men are at work on this great project and because of its isolated location a large camp, including hospitals, garages, recreation halls, dormitories, and ice plants had to be built. Excellent roads lead to the camp and there are adequate sewer, water, and electric light facilities. Altogether there are 526 buildings and the camp has every appearance of a small city.

There are four concrete mixing plants at Wilson Dam, one on the north and two on the south shore of the river and one on Jackson Island which separates the river into two channels at the dam site. The shore plants have two 2-yard mixers each and the island plant two 4-yard mixers. Large rocks, called plumbstone, are incorporated in the concrete wherever possible.

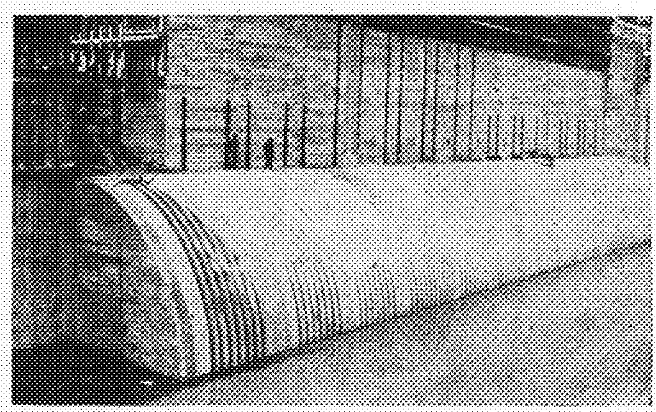
A standard gauge railroad track serves each plant. The concrete is hauled in large bottom dumping buckets on flat cars to the cranes that lift and place the concrete inside the forms.

Sand and gravel are dredged from the river bed several miles below the dam and the concrete aggregate obtained by crushing excavated rock.

An idea of the work involved may be obtained from the equipment necessary. There are 28 miles of standard gauge railway, 26 locomotives, 79 box cars and 65 flat cars, as well as 60 20-yard dump cars, 15 gondolas, and 12 locomotive cranes. Seven rock crushers, 129 rock drills and 11 steam shovels are used. Seven air compressor plants with a total air capacity per minute of 15,900 cubic feet operate the pneumatic tools. Heavy material is placed in location by seven Terry 10-ton and three McMyler 10-ton full circle cranes.

According to Lt. Col. Geo. R. Spalding, district engineer, they hope to have the dam completed in June, 1925. In the meantime the people of Florence and Sheffield, Ala., have invested every cent of their money in real estate and business is at a standstill until a decision of Congress fulfills or blasts their dreams. So anxious are the citizens of the small towns along the Tennessee river to have Ford secure the right to the power developed that the business men have raised large sums of money for lobbying purposes in Washington.

Ambitious real estate firms have laid out whole cities, with streets and all modern conveniences already in. Everywhere is a feeling of expectancy.



The Grill Work for Keeping Trash Out of the Sluices

THE ENGINEER

As the town contractors stood airing their grievances, they noted coming down the road a queer human. Somewhere, somehow, he had gotten hold of two pieces of mica held together with a bone, and which sat on his nose in such a position that he could look through them. The skins he wore were all dyed yellow, and he had made himself some queer footgear that came to his knees and were laced with deer thongs. Coming close to the contractors, he set up something like a three-legged stool, on top of which was perched a long narrow open gourd. Reaching in his pocket, he took out a stone with a leather string tied to it, which he fastened beneath the legs. Then from another gourd he filled the gourd on top, which he carefully leveled, after switching the three legs so that the swinging stone set over a place scratched on the road. After he was all set, a man driving two mastodons and a tandem hit one of the legs with a wheel. Did he cuss? No, he was an engineer.—The Constructor.

A MINER'S EXPERIENCES ABROAD

Prospecting, Inspecting, Assaying, Mining and Even Dancing Are All Part of the Day's Work

By Cyril Brackenbury, B.Sc., E.M. 1898

DURING my rather wide and varied experiences the following principles have impressed themselves on me:

1. As far as possible **enjoy** your work.
2. If you can't have lamb then fall back on ham.
3. Consider your employees from the human point of view and treat them with strict justice and they will give you good service.
4. Use your own judgment, after hearing the opinion of others.

(1) By principle No. 1, I mean that the more you can look upon your work as a game full of interesting problems the less laborious and irksome will you find any of it. In fact a great deal of it will be found delightfully interesting.

(2) If you can't get the job you want, take some other until a better opportunity offers. Being unemployed is not a good recommendation. I can remember that when I left the U. of M. I naturally wanted a job as a Mining Engineer, but as no opportunity offered I went out to Rossland, B. C., and faced the Manager of one of the big mines determined to get a job of some kind. He said he had no vacancy for a Mining Engineer at the moment but could do with an office boy, so I took this job and found some fun in it and gained some useful experience.

Following this principle I have worked with a Red Indian as a partner, breaking rocks in the stopes, pushing cars, working a rock drill and things of this kind.

(3) Either as a fellow workman or as an employer of labor I have rubbed shoulders with Red Indians, Finlanders, Cornishmen, Americans, Canadians, Russians, Khirges (Mohammedans in Siberia), South African Natives, Greeks, etc., and have always found that if you treat men squarely they will be inclined to treat you fairly in return.

(4) It is quite a good plan to get all the information you can from others when a difficult problem is before you, and you can advisely consult with others in such a case, but beware of acting on any one else's advice unless your own judgment convinces you it is the wisest course to take. If you are responsible act only on your own judgment or you may be landed.

Inside Story on Rhodesia Gold Rush

My professional experience, like that of many mining engineers, has been divided into two parts, one part concerning the management of mines, and the other the inspection and reporting on mines. Both of these branches have their own peculiar interests and problems and taken together give one a wide outlook on life and considerable knowledge of human nature.

When examining and reporting on properties I would again call attention to principle No. (4) for in this case there will generally be many persons to whose interest it is to mislead you if possible. I can recall several instances where, in my opinion, properties had been "salted" for my especial benefit, although I am thankful to say that in these cases I was taking no chances, and spotted the little game in plenty of time.

Once when in Rhodesia I was for a few days a little nervous over a report I had made for the Consolidated Gold Fields of South Africa on a so-called Gold Alluvial Area which I had been asked to examine as a side issue to my work at that time for the Consolidated African Copper Trust. I spent only one evening and night on the property but in this time had samples of the gravel taken in places selected by myself and put through a primitive rocker and then the concentrates panned under my eye. Finally the gold obtained was weighed on a balance made out of wood and cotton thread. The weight used to weigh with was, as far as I remember, a gold sovereign, or half-sovereign, and the balance had to be adjusted in such a manner as to get accurate results by calculation of proportionate lengths of the lever arm. With the results I obtained I was able to report that for an alluvial proposition the gold content was very rich showing —— dwt. to the cubic yard. **But,** I said, while the formation extends over a considerable area, the gold has only been proven over a very small portion, and in my opinion it looks more like "shed" gold than true alluvial, consequently it may be merely the concentration from a small lode in the immediate vicinity. I therefore advised the two prospectors to try and prove up a larger area, as I did not consider the very limited area proved up to that time worth considering as an alluvial proposition in view of the expense that would be involved in bringing in water for hydraulicking purposes. Until a larger area had been proven, I did not advise my company to have anything to do with the business.

After having made my report I went to the copper mines, and, returning through the so-called alluvial fields in about 10 days' time, I found prospectors hustling in from all over the country who told me about the "Great Alluvial Field" and the riches to be obtained by the first comers, etc. I told them not to be over-confident or something to this effect, and then travelled back to headquarters in Bulawayo, wondering rather nervously if by chance I had made a "bloomer."

The first paper I secured on getting back to civilization gave a glowing account of the alluvial deposits by a well known local mining engineer, stating that very rich alluvial gold had been found and that the same formation extended for miles and miles, and that therefore the prospects were extremely good, etc. This engineer failed to mention that good values in gold had actually only been found over a very small portion of the formation.

The final result was, that after about a month's working, the two prospectors obtained an average yield identical to that given in my report. They, however, failed to find an extension of the gold area, and had to give up. The rush of new prospectors found nothing and the excitement soon fizzled out.

This little example is an illustration of the harm that may be done by an engineer reporting carelessly or purposely exaggerating facts. In this case the poor prospectors or the people who sent them down were the sufferers. I was naturally pleased to find my report had given the true position of affairs so accurately.

Muffle Furnace Built Without Aid

In addition to being an expert in Mine Development a Mining Engineer should also be a "Jack of all trades" if he intends to travel far afield. As an example of the sort of thing required I can recall part of my experience in Siberia where I had to teach my Khirges and Russian workmen how to timber a shaft, drill and blast holes, etc., and had personally to build a Muffle furnace to carry out a series of gold and silver assays. The natives knew how to make ordinary rough bricks and I had to do the rest. Fortunately I had with me "Brown's Assaying" 1897 edition, used at the U. of M., which, with native bricks, bar and sheet iron, clay, bone ash, and a moderate amount of common sense, made the matter comparatively simple. With this material I turned out quite a respectable looking Muffle furnace all complete in a day or two. The furnace answered its purpose quite satisfactorily and all the fire assays were carried out without any trouble. Perhaps I should mention that in one part of Siberia I was about 500 miles from the railway and about 200 miles from the nearest other Englishman.

One morning I arrived on a visit to the Spassky mine after having lain out in the rain all the preceding night, the guide having lost his way. Towards evening when I was thinking about the good sleep I would have that night, I was told that there happened to be a dance on. I didn't feel particularly like dancing, but felt I must try and do my part. My knowledge of the Russian language being extremely limited I knew that my partner and I would have to put in most of our time at dancing since I should not be able to whisper many pretty things during the sitting out periods. On the whole I got on fairly well until the mine manager and I found ourselves booked for what was called some native dance. Having led my partner out ready for the dance I was rather taken aback to find out that when translated into English this Russian dance was neither more nor less than Kiss in the Ring. Some of the staff carried out their part manfully, but I must confess I didn't feel equal to the occasion and had to plead fatigue or some other excuse of this kind. The Russian peasants are fond of dancing, but unfortunately know very little about active and healthy games such as are played by Americans and Britishers.

Unwatering the Tresavian Mine

One of the most interesting pieces of work I have had to carry out was the Unwatering of the Tresavian Mine in Cornwall. This old mine had not been worked for over 50 years and its workings extended for a length of about three-quarters of a mile and a depth of 1,800 feet, consequently there was a very great quantity of water to be removed without counting the additional water which was bound to flow in during the period of unwatering. The story of the unwatering is a long one and cannot be given here, but may be found in the Transactions of the Institution of Mining and Metallurgy, 1911-12, Vol. XXI, in case anyone may care to refer to it. I may perhaps just mention that the work was successfully carried out by means of a series of high lift electrically driven centrifugal pumps, and the mine is today working satisfactorily as a tin producer.

Clay Mining in England

During the war I served part of the time in a tunnelling Coy. Royal Engineers, and part of the time with the Pioneers. Unfortunately I got rather badly used on one occasion, being buried by a high explosive shell and getting my neck broken during the burying process. This little event has left me not quite so strong as I used to be, and I am now content to settle down in the beautiful County of Devon where I am professionally engaged as Joint Manager of the Devon and Courtenay Clay Co., Ltd.

A fair proportion of the Ball Clay in this district is, by the way, sent to the American Market. It is extracted by means of Open Quarries and a series of very small mines. The clay, being a soft plastic substance, exerts an enormous pressure on any timber used in the process of mining. Therefore instead of trying to hold the drives open by massive timbering, reinforced concrete or some such means, we simply make short working drives, extract the timber, letting the clay come in, and then retimber, using the same sets of timber over and over again.

EDITORIALS

A COMMENCEMENT ANNOUNCEMENT

To cap the climax of a year's hard work we are giving you the "Alumni Edition" with its complete directory of the alumni of the College of Engineering and Architecture, the School of Chemistry and the School of Mines. Besides the name and address we are also giving the name of the firm with which the graduate is working and the position which he holds with them. We are proud of this edition, not because it is entirely correct (we realize that it is not), but because we think that it is a step in advance for the Techno-Log.

The editing of the first Alumni Edition has caused us to burn considerable of the midnight oil and not in the preparation for finals either because we might as well admit that we did not study for them this spring. We haven't played any tennis or golf for over a month either, but at last this issue is complete. We hope that you like our work and that you appreciate it enough to write in and correct any mistakes we may have made. Several of the "Old Grads" have written us about this issue—we trust it is what they wanted.

This year we have tried to carry out a program that would meet with the approval of all. We have published engineering articles of general interest and have endeavored to have them written in a popular style such as would appeal to the majority of our readers.

As the retiring managing editor, I want to make a few acknowledgments. First, I wish to thank Dean O. M. Leland and his staff and Dean W. R. Appleby for their assistance and helpful suggestions at all times. Without their timely aid this edition would never have been possible. And then there is Julian ("Spike") Garzon, whose hard and faithful work as Alumni Editor built up the alumni news section, established a file of records and brought us in touch with so many of the men in the field.

During the last year we have helped to bring the engineers closer together and to get them to pull together for Minnesota. To next year's staff I wish Godspeed for honor and service and Minnesota.

CLARENCE W. TEAL.

ALUMNI NEWS

BE MERCIFUL

As this is the first list of alumni of this College published in many years, errors will undoubtedly occur notwithstanding our efforts to obtain correct and up-to-date information. We hope to republish this list next year with additions and corrections. Alumni are requested to notify the Dean's office at once of any errors or omissions which they may discover.

LIST OF ALUMNI

Engineering and Architecture
University of Minnesota

COURSES: A., Architecture; Ae., Architectural Engineering; C., Civil Engineering; E., Electrical Engineering; G., General Engineering; M., Mechanical Engineering.

ADVANCED DEGREES: C.E., Civil Engineer; E.E., Electrical Engineer; M.E., Mechanical Engineer.

*Deceased.

Aasland, Arne 1923 C.
2341 James Ave. N., Minneapolis.
Salesman, Harrison-Smith Co.

Aasland, Christopher 1915 C.
Box 996, Miles City Mont.
Engineer, Montana R. R. Co.

Abbott, Amos Herbert 1916 E., 1917 E.E.
1854 Grand Ave., St. Paul, Minn.
Engineer, St. Paul Gas Light Co.

Abbott, Arthur Laurie 1897 E.
2890 Commonwealth Ave., Minneapolis, Minn.
Manager, Commonwealth Elec. Co., St. Paul.

Abrahamson, Howard Benjamin 1918 M.
312 Y. M. C. A., St. Paul, Minn.
Engineer, St. Paul Gas Light Co.

Abramson, Harry W. 1923 C.
100 E. Washington Ave., Springfield, Ill.
Jun. Testing Engr., Ill. State Highway Dept.

Acker, Sidney Harold 1923 M.
Room 1134, N. P. Bldg., St. Paul, Minn.
Asst. Operator, Dynamometer Car, N. P. R. R.

Acomb, Wm. Edward 1902 M.
1011 N. Sheridan Road, Waukegan, Ill.
Supt., American Steel & Wire Co.

Adams, Benjamin W. 1910 C.
Seattle, Wash.
Asst. Engineer M. of W.

Adams, Edward Hayford 1921 G.
Linden Hill Station, Rt. No. 2, Minneapolis, Minn.
E. H. Adams Const. Co., 403 Essex Bldg.

Adams, Elmer Ellsworth 1906 C.
1918 2nd Ave. N., Great Falls, Mont.
District Engr., G. N. R. R. Co.

Adams, George Francis 1895 E.
25 Church St., New York, N. Y.
Manager, Triumph Electric Co.

Adams, John W., Jr. 1912 C.
2313 Grand Ave., Minneapolis.
Secretary, Hennepin Holding Co.

Adams, Wm. Charles 1905 E.
71 Arlington Ave., Westmount, Quebec.
Chief Engineer, Northern Electric Co., Ltd., Montreal.

Adler, Eugene H., 1914 E, 1915 E.E.
203 E. 19th St., Minneapolis, Minn.
Salesman, Spector Apt Co.

Ainslie, Arthur Frederick 1911 C.
Staples, Minn.
Asst. Engineer, N. P. R. R.

Albrecht, George M. 1906 E.
Milwaukee, Wis.
Asst. Patent Attorney, Allis Chalmers Mfg. Co.

Aldrich, Louis W. 1923 C.
680 "E" St., San Bernadino, Calif.
Draftsman, California Highway Commission.

Alexander, George Dewey 1920 C.
816 6th Ave. S., Minneapolis, Minn.
Municipal Work, John W. Stoffer Co.

Allbee, Pierce 1916 A.

Allee, David Arthur 1902 C.
325 Glenwood Blvd., Schenectady, N. Y.
Engineer, General Electric Co.

Alrick, Bannona Gerhardt 1906 C.
2746 13th Ave. S., Minneapolis.
Asst. Engineer, C. A. P. Turner Co.

Alsop, Ernest Benhow 1906 C.
Route No. 2, Boise, Idaho, or Fargo, N. D., care H. T. Alsop.
Engineer and Superintendent, Morrison-Knudsen Co., Arling, Idaho

Alton, Herbert Dennett 1907 E.
E. 507 23rd Ave., Spokane, Wash.
Electrical Contractor.

Amidon, Lee Leonard 1923 M.
48 Wiley Drive, Morgantown, W. Va.
Instructor, Steam and Exp. Engr., West Virginia University.

Anderson, Arthur Reynold 1912 E.
1114 Mission St., San Francisco, Cal.
Salesman, Lundstrom Hat Works.

Anderson, Christian 1888 C.
466 10th St., Portland, Ore.
Senior Highway Engineer, U. S. Bureau Public Road.

Andersen, Edward Ignatius 1917 M., 1919 M.E.
Hotel Liberty, Attica, N. Y.
Assistant to Works Manager, Westinghouse Elec. & Mfg. Co.

Anderson, Edward Sigfrid 1921 E.
Box 457, International Falls, Minn.
Electrical Construction Engineer, Minnesota & Ontario Paper Co.

Andersen, Emil 1905 E.
5235 Upton Ave. S., Minneapolis.
Secretary, Standard Electric Service Co.

Anderson, Frank Arthur 1908 E.
1322 Wisteria Ave., Portland, Ore.

Anderson, Frank Lawrence 1916 E.
1416 North Snelling Ave., St. Paul, Minn.
Engineer, Maintenance and Construction, Anderson Co.

Anderson, George Theodore 1915 C.
502 W. Pine St., Chisholm, Minn.
City Engineer.

Anderson, Harvey B. 1912 C., 1913 C.E.
Hopkins, Minn.

Anderson, Helmer Nicholai 1920 M.
1757 Capitol Ave., St. Paul, Minn.
Sales Engineer, Worthington Pump & Machinery Corporation.

Anderson, Hilder Alvin 1918 M.
2112 5th Ave. S., Minneapolis.
Chief Engineer, Mahr Mfg. Co.

Anderson, John G. 1899 C.
4145 Park Ave., Minneapolis, Minn.
Assistant Engineer, M. St. P. & S. Ste. M. R. R.

Anderson, Joseph W. 1915 E.
111 East 36th St., Minneapolis.
Engineer, Northwestern Bell Telephone Co.

Anderson, Martin E. 1901 E.
818 So. Corona St., Denver, Colo.
Patent Attorney, care A. J. O'Brien.

Anderson, Milton J. 1920 A.
9 E. Graham St., Madison, Wis.
Draftsman, Law & Law.

Anderson, Milton Lawrence 1921 A.
1246 Ingraham St., Los Angeles, Calif.
Arch. Draftsman, John M. Cooper.

Anderson, Nels Sevrin 1922 C.
3136 1st Ave. S., Minneapolis, Minn.
Draftsman, Schuedt-Meier Co.

Anderson, Ole Andreas 1893 M., 1908 M.E.
Hawley, Minn.
W. G. Gray & Co., Minneapolis.

***Anderson, Ole John** 1893 C.

Anderson, Oscar P. 1910 E.
168 N. 18th St. E., Orange, N. J.
Commercial Engineer, Edison Lamp Works, Harrison.

Anderson, Oscar Victor 1910 E.
82 Indian Road Crescent, Toronto, Ont.
Supt., TNP. Div., Toronto Hydro Electric System.

Andrews, George Cutler 1887 M.
2629 University Ave. S. E., Minneapolis, Minn.
Manager President, Andrews Heating Co.

Andrews, George L. 1905 M.
R. F. D. No. 2, Canterbury Road, Euclid, Ohio.

Andrus, Harry J. 1922 C.
1868 Commonwealth Ave., Brookline, Mass.
Massachusetts Forestry Dept.

Andrus, Raymond Joel 1907 E.
Apt. 4, 1868 Commonwealth Ave., Brookline, Mass.
Engineer, care Twin State Gas & Electric Co., Boston.

Arnesen, Herbert P. 1911 C.
Newport, Minn.
Estimator, Toltz, King & Day, St. Paul.

Arneson, Lloyd Olaf 1921 M.
1835 E. 79th St., Ste. 8, Cleveland, Ohio.
Engineer, Bailey Meter Co.

Arneson, Timothy George 1916 E.
The Leamington, Minneapolis, Minn.

Armstrong, Thomas Stanley 1906 M.
1416 2nd Ave. N., Great Falls, Mont.

Arzt, Emmanuel Arthur 1899 E., 1897 Sci.
211 Fifth St., Sioux City, Ia.
Proprietor, Electrical Construction Co.

Ascher, Raymond Christopher 1923 M.
Lackawanna Club, Lackawanna, N. Y.
Asst. Billet Yard Foreman, Bethlehem Steel Co.

Ash, James Wesley 1908 C.
1902 Washington Ave., Des Moines, Ia.
Landscape Architect, American Horticulture Co.

Ashbaugh, Lewis E. 1900 M., 1907 C.E.
562 Upper Mountain Ave., Montclair, N. J.
Civil Engineer, Consulting Practice, New York City.

Ashworth, Roy Henry 1911 E.
1st and 3rd Ave., Salt Lake City, Utah.
Assistant to General Manager, Utah Power & Light Co.

Aske, Irving E. 1920 E.
3161 Hiawatha Ave., Minneapolis.
President and General Manager, Kase Elec. Co., Inc.

Askew, Thomas Archer, Jr. 1916 C.
Plainview, Minn.
Assistant Manager, Thomas Askew Co.

Aslakson, Baxter Martin 1891 M.
764 Oakwood Blvd., Chicago, Ill.
Consulting Engineering.

Aslakson, Carl Ingman 1923 C.
Okeechobee, Fla., care Launch Elsie.
Deck Officer, U. S. Coast & Geod. Survey, Washington, D. C.

Asleson, Hans J. 1910 C.
4909 Dupont Ave. S., Minneapolis.
Engineer, Sales Dept., Minneapolis Steel & Machinery Co.

***Atkinson, Wm. B.** 1910 M.

Aultfather, David H. 1922 E.
5016 W. 24th St., Cicero, Ill.
Equipment Engineer, Western Electric Co., Chicago.

Aure, Roy 1922 M.
Y. M. C. A., St. Paul, Minn.
Draftsman, N. P. Ry.

Austin, Paul D. 1921 E.
2729 Aldrich Ave. S., Minneapolis.
Sales Dept., Minneapolis General Electric Co.

Avery, Henry Brinckerhoff 1893 M., 1898 M.E.
"Applegarth," Christmas Lake, Excelsior, Minn.
Salesman and apple grower.

***Avis, S. L.** 1912 E., 1913 E.E.

Babcock, Vernon Mathias 1923 E.
227 Xerxes Ave. N., Minneapolis.
Sales Engineer, Cutler Hammer Mfg. Co., Milwaukee, Wis.

Bachmann, Graydon A. 1923 M.
383 Herschel Ave., St. Paul, Minn.
Asst. Service Manager, N. W. Nash Motors Co.

Bachrach, Alfred 1908 E.
724 So. Spring St., Los Angeles, Cal.
Commercial Dept., General Electric Co.

Backstrom, Wilburg A. 1923 A.
827 21st Ave. S., Minneapolis, Minn.
Arch. Draftsman, Tyrie & Chapman.

Baer, Louis Edward 1907 E.
1370 Thomas St., St. Paul, Minn.

Bailey, George R. 1922 C.
4501 Washburn Ave. S., Minneapolis, Minn.
American Telephone and Telegraph Co.

***Bailey, William Henry** 1912 C., 1913 C.E.

Baker, Arthur 1919 M.
Spirit Lake, Idaho.
Spec. Appr., C. M. & St. P. Ry.

Bakken, Lawrence H. 1922 A.
4819 29th Ave. S., Minneapolis.
N. W. Lumbermen's Assn.

Ball, Hampton B. 1920 M.
Troy, Mo.
Farmer and Poultryman.

Barber, Harold Alvah 1921 C.
Camp 62, Big Creek, Cal.
Southern California Edison Co.

Barger, Harold L. 1921 E.
819 16th Ave. N., Minneapolis.
Electrical Engineer, Ford Motor Co.

Barlow, Harry Elmore 1903 C.
2352 Bourne Ave., St. Paul, Minn.
Chief Engineer, C. St. P. M. & O. Ry.

Barnes, Dean M. 1921 E.
750 Rose Ave., Long Beach, Calif.
Engineering Dept., Associated Telephone Co.

Barnum, Marvin Culver 1911 M.
503 So. 6th St., Minneapolis, Minn.
President, Northern Machinery Co.

Barr, John Henry, 1883 M., 1888 M.E.
36 Gramercy Park, New York City.
Consulting Engineer, Remington Typewriter Co.

***Batchelder, Frank Leslie** 1893 C.

Bates, Albert Henry 1905 M.
2819 W. 42nd St., Minneapolis.
Works Manager, Emerson-Brantingham Co.

Batson, Charles Drewry 1907 C.
912 Goodrich Ave., St. Paul, Minn.
Local Manager, Republic Creosoting Co., Mobile, Ala.

Battles, Leon E. 1918 C.
Coleraine, Minn.
Mining Engineer, Oliver Mining Co.

Bauer, Roscoe 1924 C.
Milwaukee, Wis.
U. S. Eng. Corp.

Bauer, Ruben Bernard 1920 E.
1312 Leland Ave., Apt. 1, Chicago, Ill.
Engineer, Western Electric Co.

Bayless Harry Cornelius 1899 M.
7140 Coles Ave., Chicago, Ill.
Western Manager, Business Training Corporation.

Bean, William Lloyd 1902 M.
373 Union Ave., West Haven, Conn.
Mechanical Assistant to President, N. Y. N. H. & H. R. R. Co.

Beardmore, Albert E. 1921 E.
703 Union St., Schenectady, N. Y.
Designing Engineer, Induction Motor Dept., General Electric Co.

Beaulieu, Richard Lawrence, 1902 C.
Everett, Wash.
Manager, American Pile Driving Co.

Beck, Vernon S. 1910 E.
3042 Irving Ave. S., Minneapolis.
General Contractor, 1150 Plymouth Bldg.

Becker, Ward E. 1917 E.
Aberdeen Proving Ground, Maryland.
First Lieut., Ordnance Dept., U.S.A.

Beckjord, Walter Clarence 1909 E.
120 Broadway, N. Y.
Chief Engineer, American Light & Traction Co.

Beeman, Harry John 1921 G.
Care Frank H. Beeman, Ashton, Idaho.
Inspector of Pavements, Minnesota Highway Dept., St. Paul, Minn.

Beery, Charles B. 1909 M.
95 N. Elm, Minneapolis, Minn.
Building and renting.

Bell, Maurice Dwight 1907 M.
1416 W. 27th St., Minneapolis, Minn.
Washburn-Crosby Co. "A" Mill Office.

Benedict, George Fred 1903 E.
949 Burwell, Bremerton, Wash.
Chief Draftsman, U. S. Navy Yards, Puget Sound.

Beneke, Walter E. 1920 C.
722 So. Alvarado, Los Angeles, Cal.
Fieldman, Union Oil Co., Wilmington.

Bennett, Walter James 1903 C.
2755 Belvedere Ave. S. W., Seattle, Wash.
Asst. Engineer, Bridge Dept., Great Northern Ry.

Benham, Claude F., 1912 E., 1913 E.E.
14 Sansome St., San Francisco, Cal.

Berdan, Hubert J. 1922 C.
Wissota Dam, Chippewa Falls, Wis.
Field Engr., Wis.-Minn. Light & Power Co.

Beredict, Fred 1903 E.
949 Burwell, Bremerton, Wash.
Mechanical Engineer, Navy Dept.

Berg, Samuel Arnold 1922 E.
327 Pitt St., Wilkinsburg, Pa.
Westinghouse Electric Co., East Pittsburgh.

Berg, Karl A. E. 1920 C.
520 Securities Bldg., Billings, Mont.
Asst. Geologist, N. P. R. R. Co.

Berg, Swan P. 1923 C.
1412 Portland Ave., Minneapolis.
Draftsman, Soo Line R. R.

Bergford, Rolf E. 1923 C.
1918 Russell Ave. N., Minneapolis, Minn.
Asst. Engineer of Tests, Minnesota Highway Dept., St. Paul.

Bergoust, Oscar J. 1908 C.
Address unknown; information requested.

Bergsland, Grant C. 1923 M.
Y. M. C. A., La Crosse, Wis.
Master Mechanic, Wis. Ry. Lt. & Power Co.

Bergstrom, Marlow Benjamin, 1922 E.
1625 Portland Ave., St. Paul, Minn.
Westinghouse Electric Mfg. Co., Wilkinsburg, Penn.

Bergquist, John Emil 1913 C.
1100 N. Laramie Ave., Chicago, Ill.
Designer, Robins Conveyer Belt Co.

Bergford, Lester 1923 C.
2117 Kenwood Blvd., Minneapolis, Minn.
Field Engineer, Portland Cement Assn.

Bernt, Hans E. 1920 C.
301 101st Ave. W., New Duluth, Minn.
Field Civil Engineer, Minnesota Steel Co.

***Beyer, Adam Carl** 1896 C.

Beyer, Theodore Alexander 1903 C.
706 Kearns Bldg., Salt Lake City, Utah.
Vice President, Burke & Co.

***Bieri, John B.** 1909 M.

Bierman, George Henry 1918 M., 1919 M.E.
15800 Euclid Ave. E., Cleveland, O.
Asst. Metallurgist, White Motor Co., Minneapolis, Minn.

Bill, Earl McMaster 1912 E.
18 Hamton Ave., Schenectady, N. Y.
Ry. & Tr. Eng. Dept., General Electric Co.

Billau, Lewis Scoville 1905 E.
715 W. North Ave., Baltimore, Md.
Asst. Electrical Engineer, B. & O. R. R.

Bingen, Wm. J. 1912 C., 1913 C.E.
Andover, S. D.
College of Engineering, University of Illinois, Urbana, Ill.

Bingham, Stanley Eugene 1908 M.
875 St. Clair St., St. Paul, Minn.
Bingham & Norton, Inc. (motor cars.)

Birnberg, Zingel C. J. 1909 M.
227 Fairgreen, Youngstown, O.
Checker, Carnegie Steel Co.

Bisbee, Bertin A. 1922 E.
Austin, Minn.

Bisbee, Elmer 1905 C.
San Francisco, Calif.
Masonic Club, Palace Hotel.

Bisek, Peter Paul 1914 E.
Williston, N. D.
Asst. Supt., Reclamation Service.

***Bishman, Adam Edgar** 1895 E.

Bishop, Ira Lynn 1911 M.
844 Grand View Ave., Duluth, Minn.
Gen. Supt., Clyde Iron Works.

Biskup, William Frank 1916 C.
2091 Princeton Ave., St. Paul, Minn.
Concrete Reinforcing Dept., Mpls. Steel & Machinery Co.

Bjonerud, Earl Stanley 1923 E.
San Francisco, Cal.
Electrical Engineer, General Electric Co.

Bjorge, Oscar Bernard 1907 M.
1221 E. 5th St., Duluth, Minn.
Willamette Iron & Steel Works, Portland, Ore.

Blake, Henry Barnard 1901 E.
Lightcap, S. D.
Ranching.

Blake, Robert Pennell 1897 M.
Park Hotel, Livingston, Mont.
Division Master Mechanic, Montana Division, N. P. Ry.

Bleecher, George Wright 1916 E.
4944 Russell Ave. S., Minneapolis, Minn.
Estimating Engineer, Sterling Electric Co.

Bleifuss, Donald J. 1920 C.
605 3rd St. N. W., Faribault, Minn.
Phoenix Utility Co., Duluth, Minn.

Blomberg, Evar Harry 1917 E.E.
Eagle Bend, Minn.
Evangelist.

Blomquist, Hjalmar F. 1907 C.
1837 7th Ave. E., Cedar Rapids, Ia.
Supt., City Water Works, City Hall.

Blossom, George Wm. 1911 E.
221 Mississippi River Blvd., St. Paul, Minn.
Vice President, Geo. C. Christian & Co., Minneapolis.

Bockus, Gerald H. 1922 E.
825 4th Ave. S., Apt. 320, Minneapolis, Minn.
Radio Engineer, Beamish Elec. Co.

Boehnlein, Charles, 1917 M., 1919 M.E.
2004 Grand Ave. S., Minneapolis, Minn.
Instructor, Mathematics and Mechanics, University of Minnesota.

Boerner, Francis C. 1911 C.
3800 Columbus Ave., Minneapolis.
Architect and Engineer, Croft & Boerner.

Bohland, John Adam 1895 C.
1233 Montreal Ave., St. Paul, Minn.
Bridge Engineer, G. N. Ry.

Bolme, Ole Martin 1910 C.
15 Park Row, New York.
Designer and Estimator, Robins Cons. Belt Co., New York City.

Boman, Carl Emanuel 1905 E.
156 N. Grove St., East Orange, N. J.
463 West St., New York City.

Borrowman, Leroy F. 1908 C.
1192 Wolesly Ave., Winnipeg, Can.
Member, Sutherland Construction Co., Ltd.

Bosshardt, Willmert C. 1922 E.
297 E. Robie St., St. Paul, Minn.
Purchasing Agent, New Liberty Washing Machine Co.

Bouge, Nathan Herschel 1904 C.
Washtucna, Minn.

Bauman, Bernhard M. 1904 E.
25 8th St., Great Neck, N. Y.
Equipment Engineer, Western Elec. Co., New York City.

Bouquet, Otto T. 1923 E.
619 11th Ave. S. E., Minneapolis.
Salesman, Northern States Power Co.

Bowen, Fred Pabst 1906 C.
3738 38th Ave. S. W., Seattle, Wash.
Structural Draftsman, City Engineer's Office.

Boyce, Ellsworth R. 1917 C.
Box 442, Rochester, Minn.
Highway Engineer, Olmsted Co.

Boyce, Leonard F. 1912 M.
Boyce-Greeley Bldg., Sioux Falls, S. D.
President, Sioux Falls Construction Co.

Boyles, Ralph R. 1915 M., 1916 M.E.
1966 St. Clair St., St. Paul, Minn.
Designing Engineer, American Hoist & Derrick Co.

Boyum, Benjamin C. 1910 C.
Peterson, Minn.
Architect and Engineer.

Boyum, Irvin 1917 E.
107 Melbourne Ave. S. E., Minneapolis, Minn.
Switchboard & Service Dept., Westinghouse Elec. & Mfg. Co.

Brachrach, Alfred 1908 E.
Los Angeles, Calif.
General Electric Co.

Braden, Rene A. 1923 E.
410 S. E. Harvard, Minneapolis, Minn.
Assistant, Electrical Engineering Dept., University of Minnesota.

Bradley, Byron Harry
1913 E., 1914 C.E.
Logan, Ia.
Office and Field Engineer, C. L. Huff, Civil Engineer.

Brataas, Mark Girard 1917 C.
Breckenridge, Minn.
Highway Engineer, Wilkin County.

***Bray, George Eben**
1894 M., 1904 M.E.

Brenchley, Harry E. 1908 C.
4833 Upton Ave. S., Minneapolis.
Manager Structural Sales, Minneapolis Steel & Machinery Co.

Brenchley, Walter C. 1915 C.
805 Newhouse Bldg., Salt Lake City, Utah.
Contracting Engineer, Mpls. Steel & Machinery Co.

Brewster, Wm. Edwards
1912 E., 1913 E.E.
416 Pine Ave., Niagara Falls, N. Y.
Advertising Manager, U. S. Light & Heat Corp.

Briggs, Hiram Kenneth 1919 G.
1601 W. 27th St., Minneapolis, Minn.
Metallurgist, Minneapolis Electric Steel Castings Co.

Briggs, William G. 1921 E.
1716 4th St. S. E., Minneapolis.
Principal at Hannah High School, Hannah, N. D.

Brockway, Alvah E. 1909 E.
Sacramento, Calif.

Brockway, Roydon Ray 1905 C.
610 6th St. S. E., Minneapolis.
Chief Draftsman, Bridge Engineer's Office, N. P. Ry., St. Paul.

Brooke, Harold Lee 1918 E.
2736 Virginia Park, Detroit, Mich.
Sales Engineer, C. G. Spring Co.

Bros, Bernard M. 1923 M.
1767 Fremont Ave. S., Minneapolis, Minn.
Wm. Bros Boiler Mfg. Co.

Bros, Chester W. 1922 M.
677 13th Ave. N. E., Minneapolis.
Wm. Bros Boiler & Mfg. Co.

Bros, Ernest Theodore 1917 M.
4917 Garfield Ave. S., Minneapolis.
Wm. Bros Boiler & Mfg. Co.

Bros, Raymond Joseph
1919 M., 1920 M.E.
4032 Garfield Ave. S., Minneapolis.
Engineer, Wm. Bros Boiler & Mfg. Co.

Brossard, Edward V. 1923 M.
1823 Marshall Ave., St. Paul, Minn.
Sales Engineer, St. Paul Gas & Light Co.

Brown, Geo. J. 1908 E.
Suite 3, 634 Broadway, Winnipeg, Can.
Engineer of Mechanical Services, Province of Manitoba.

Brown, Floyd W. 1917 A.
43 Dell Place, Minneapolis, Minn.
Senior Draftsman, A. R. Van Dyck.

Brown, Harry E. 1922 G.
87 N. Prior Ave., St. Paul, Minn.
Salesman, Fairbanks, Morse & Co.

Brown, Homer L. 1917 M.
Y. M. C. A., Aurora, Ill.
Inspector Metallurgist, C. B. & Q. R. R. Laboratory.

Brown, Louis Marston 1916 E.
126 Ave. F, East Pittsburgh, Pa.
Switchboard Engineer, Westinghouse Electric & Mfg. Co.

***Brown, Oliver Lindley** 1907 M.

Brown, William Penn 1912 M.
680 Mandana Blvd., Oakland, Cal.
Partner, Brown Bros. Welding Co., San Francisco.

Brownell, Otto E. 1910 C.
4125 Upton Ave. S., Minneapolis, Minn.
Assistant Engineer, State Board of Health.

Bruce, Hjalmar Nels
1916 C., 1917 C.E.
3450 11th Ave. S., Minneapolis.
Manager, A. M. Chesher Prtg. Co.

Buck, Frederick William 1909 M.
524 Woodlawn Ave., Minneapolis, Minn.
Secretary, Stryker Manley & Buck, Duluth.

Buckhout, Donald H. 1917 A.
River Home, Perrysburg, O.
Arch. Draftsman, Geo. B. Rheinfrank, Toledo.

Buenger, Albert 1913 M., 1914 M.E.
1666 Stanford Ave., St. Paul, Minn.
Mechanical and Electrical Engineer, C. H. Johnston.

Buenger, Edgar 1919 A.
1715 Jefferson Ave., St. Paul, Minn.
Designer, Ellerbe & Co.

Buhl, John E. 1909 M.
102 Remsen St., Brooklyn, N. Y.
Engineer, Turner Const. Co., New York City.

Buhl, Paul S. 1907 M.
509 Florence Ave., Avalon, Pa.

Bumgardner, Louis T. 1923 E.
370 Lookout Place, St. Paul, Minn.
Electrical Engineer, J. H. A. Brahtz.

Buhr, Leo 1923 C.
Danbury, Wisconsin.
Northern States Power Co.

Bunce, Paul Fay 1906 E.
903 5th Ave. S., Fargo, N. D.
Div. Supt. of Traffic, N. W. Tele-

Burch, Albert Morgan 1896 C.
3145 5th Ave. S., Minneapolis.
President, Minneapolis Steel Construction Co.

Burch, Edward P. 1892 E., 1898 E.E.
1729 James Ave. S., Minneapolis.
Consulting Engineer.

Burke, Roy L. 1905 C.
823 East First St., Duluth, Minn.
Member of firm, Bowe & Burker, mine operation.

Burnett, H. V. 1914 C.
Hampshire Arms, Minneapolis.
526 McKnight Bldg.

Burns, Harvey Lynn 1902 E.
335 S. Ashland Ave., LaGrange, Ill.
Supt. of Inspection, Western Elec. Co., Chicago.

Burrill, Charles Martin 1923 E.
1 Willow Ave., Schenectady, N. Y.
Radio Dept., General Electric Co.

Burrows, Robert Penn 1911 E.
1735 Shaw Ave. E., Cleveland, O.
President and Treasurer, Electric Sales & Engineering Co.

Burt, Fred Richard 1916 E.
Murrysville, Pa.
Gen. Engr. Dept., Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Burt, John Lucious 1890 C.
Haciendado, Mex.
Biscuit Manufacturer, Cia Galletera Nacional, Guadalajara.

Burtis, William Henry 1892 E.
Main St., Armour, S. D.
Manager, Consumers Utility Co.

Burwell, Loring Dunham 1907 M.
Philadelphia, Pa.
Engineer, Westinghouse Elec. & Mfg. Co.

Bushnell, Charles Spencer 1878 M.
1937 3rd Ave. W., Seattle, Wash.
Construction Engineer, Shell Oil Co.

Bushnell, Elbert Ellsworth 1885 M.
248 S. Broadway, Los Angeles, Cal.
Manufacturing Typewriter Supplies.

Butterworth, Allan Coffman 1911 E.
Hurley, Wis.
Electrical and Mechanical Engineer, Montreal Mining Co.

Butterworth, Russell Irvin
1916 E., 1917 E.E.
118 E. 7th St., Sedalia, Mo.
General Engineer, City Light & Traction Co.

Calmeyer, John Peter 1906 E.
369 Snelling Ave., St. Paul, Minn.

Capstick, Donald Walker 1922 G.
Apt. 9, 1202 7th St. S. E., Minneapolis, Minn.
Sales Manager, American Blower Co.

Carlson, Anders John
1916 C., 1917 C.E.
520 S. E. Delaware St., Minneapolis.
Assistant Professor of Mine Plant and Mechanics, University of Minnesota.

Carlson, Arvid Paul 1917 M.
3301 22nd Ave. S., Minneapolis, Minn.
Engineer, St. Paul Gas Light Co.

Carlson, Chauncy Martin 1917 E.
1618 Charles St., St. Paul, Minn.
Electrical Distribution Engineer, St. Paul Gas Light Co.

Carlson, Ernest Frederic 1922 M.
3813 Elliot Ave., Minneapolis, Minn.
Power Dept., Mpls. Street Ry. Co.

Carlson, C. Philip 1921 E.
Eveleth, Minn.
Instructor, Eveleth Junior College.

Carlson, Richard E. 1922 E.
1634 48th Count, Cicero, Ill.
Production Course, Western Elec-

Carlson, Victor Harry 1920 E.
Tocopilla, Chile, S. A., via Antofagasta.
Junior Electrical Engineer, Chile Exploration Co.

Carlton, Richard Paul 1921 G.
2534 17th Ave. S., Minneapolis, Minn.
Engineer, Minn. Mining & Mfg. Co., St. Paul.

Carpenter, Hugh Westcott 1921 C.
3725 E. 4th St., Long Beach, Calif.

Carr, Harvey Chandler 1903 C.
625 Grand Ave., St. Paul, Minn.
Wells-Dickey Co., Minneapolis.

Carter, Robert J. S. 1908 E.
4041 Dupont Ave. S., Minneapolis, Minn.
Vice President and Sales Manager, Carter Mayhew Mfg. Co.

Casberg, James William 1908 E.
Weyburn, Sask., Canada.

Case, Gerald F. 1923 E.
The Church Club, 614 Portland Ave., St. Paul, Minn.
Computer, G. N. Ry. Co.

***Casseday, George A.** 1895 C.

Cerney, Glen Cray 1920 M.
Bombay, India.
Lubricating Engineer, Standard Oil Co. of New York.

Chalmers, Charles Henry
1894 E., 1903 E.E.
523 7th St. S. E., Minneapolis, Minn.
Chalmers Oil Burner Co.

***Chamberlain, Herbert Dell** 1918 C.

***Chapin, Lewis Paul** 1897 Chem.

Chapman, Arthur G. 1911 E.
77 So. Munn Ave., East Orange, N. J.
American Tel. & Tel. Co., New York City.

Chapman, Burton L. 1910 C.
Rock Island, Ill.
Chief Draftsman, War Dept., U. S. Engineer Office.

Chapin, Harold S.
1912 M., 1913 M.E.
1440 Maryland Ave., Milwaukee, Wis.
District Manager, Concrete Engineering Co.

Chapman, Leslie Howard 1895 C.
966 St. Clair St., St. Paul, Minn.
Civil Engineer, N. P. Ry.

Chapman, Wendell Phillips 1914 E.
2220 Scudder Ave., St. Paul, Minn.
Division Engineer, Minnesota Highway Dept.

Chase, Arthur William 1893 E.
85 E. 6th St., Atlanta, Ga.
A. W. Chase Co.

Cheney, Edward Joseph 1904 E.
374 Fisher Ave., White Plains, N. Y.
Cons. Engr., New York City.

Chermus, Maurice C. 1922 C.
2435 1st Ave. S., Minneapolis, Minn.
Chermus Construction Co.

Chestnut, George L. 1897 E.
Houston, Texas.
Telephone Engr., Western Elec. Co.

Childs, Hervey Bulter 1906 C.
Anoka, Minn.
County Highway Engineer, Court House.

Childs, James Alanson 1909 C.
1988 Summit Ave., St. Paul, Minn.
Engr., State Board of Health, University of Minnesota.

Childs, John Chauncey 1906 C.
13 Radcliffe Road, Cynwyd, Pa.
Dist. Sales Mgr., The Austin Co.,

Chilton, Edward Gummer
1913 C., 1914 C.E.
1002 Summit Ave., Detroit, Minn.
Resident Engr., Minnesota Highway Dept., Callaway.

Chowen, Walter Abram 1891 C.
The Uplands, No. 94, Berkeley, Cal.
Mgr., California Inspection Rating Bureau, San Francisco.

Christensen, Edgar William 1919 E.
Transmission Engr., N. W. Bell Tel. Co., Omaha, Nebr.

Christianson, Hilmar Barman 1915 C.
844 Lincoln Ave., Beloit, Wis.
Asst. Engr., C. M. & St. P. Ry.

Christilaw, George M. 1921 C.
136 Western Ave. N., St. Paul, Minn.
Instrument man, Minnesota Highway Dept., Ramsey County.

Christlieb, Frank B. 1923 C.
Long Prairie, Minn.
Asst. County Engr., Todd County, State Highway Dept.

Clarke, Charles P.
1908 C., 1909 C.E.
1234 Oakland Ave., Milwaukee, Wis.
Draftsman, Warden-Allen Co.

Clark, John S. D. 1922 M.
1400 Portland Ave., Minneapolis, Minn.
Dist. Methods man, N. W. Bell Telephone Co.

Clark, Wm. Gibson
1912 M., 1913 M.E.
1935 Bryant Ave. S., Minneapolis, Minn.
Chief Engr., Pure Oil Co.

Clausen, Elmer W. 1923 E.
Madison, Minn.
Commonwealth Edison Co., Chicago, Ill.

Clipfell, Carroll Dale 1905 M.
Route 4, Box 19, Redwood Falls, Minn.
Farmer.

Cobban, Rollo J. 1909 E.
505 Mueller Apt., Butte, Mont.
Branch Mgr., Westinghouse Elec. & Mfg. Co.

Coe, Clarence Stanley 1889 C.
80 Almeria St., St. Augustine, Fla.
County Engr., Duval County, Jacksonville.

Coe, Edward Harold 1919 C.
Fort Humphreys, Va.
Second Lt. Corps of Engrs., U. S. Army.

Cohen, Nathan 1906 E.
466 H St. S. W., Washington, D. C.

Coleman, Frank D. 1905 E.
3104 4th Ave. N., Billings, Mont.
Manager, Billings District of Mont. Power Co.

Collins, Stewart G. 1904 G.
823 W. Minnehaha Pkwy., Minneapolis, Minn.
Collins-Kennison Co.

Colson, Lauren Gilbert 1921 E.
845 Lakeside Place, Chicago, Ill.
Junior Engr., Commonwealth Edison Co.

Colvin, James A., 1914 M., 1915 M.E.
2886 James Ave. S., Minneapolis.
Generation Dept., Northern States Power Co.

Comb, Fred Rundle 1919 M.
4617 Bloomington Ave., Minneapolis, Minn.
Partner, Fred R. Comb Co.

Cook, Harry C. 1910 M.
607 3rd St., Red Wing, Minn.
Owner, Red Wing Iron Works.

Comstock, John Walter 1908 C.
Petaluma, Calif.

Conley, Wilfred Edmund 1910 E.
Nela Park East, Cleveland, Ohio.

Converse, Clovis M. 1909 E.
1918 Goodrich Ave., St. Paul, Minn.
Manager, St. Paul Electrical Co.

Cook, Robertson 1902 M.
1861 E. Madison St., Portland, Ore.
Service Engr., Portland Gas & Coke Co.

Cook, Walter K. 1922 C.
Joliet, Ill.
Eng. Dept., Joliet & Eastern R. R.

Cooley, Gilbert 1922 E.
76 W. 3rd St., St. Paul, Minn.
Estimator, Northern States Power

Cooper, Leo Henry 1906 E.
3951 Thomas Ave. S., Minneapolis.
Dist. Mgr., Frank Adam Elec. Co., St. Louis, Mo.

Copeland, Floyd E. 1923 M.
Y. M. C. A., Oak Park Ill.
Student, Chicago Central Sta. Institute, Chicago.

Cornelius, Martin 1906 E.
1020 Savannah Ave., Wilkinsburg, Pa.
Elec. Engr., Westinghouse Elec. & Mfg. Co., Pittsburgh.

Corser, John 1916 M.
615 James Ave. N., Minneapolis.
Mech. Draftsman, Flaxlinum Insulating Co., St. Paul.

Cosh, Richard Alexander 1919 M.
914 Washington Ave., Alton, Ill.
Mach. Designer, Ill. Glass Co.

Cottingham, Geo., Jr. 1915 C.
915½ Sunnyside Ave., Chicago, Ill.
Maintenance of Way, C. G. W. Ry.

Cottingham, William P. 1911 C.
737 Tyler St., Gary, Ind.
City Engineer, City Hall.

Cotton, Ernest Harold 1919 E.
1688 Berkeley Ave., St. Paul, Minn.
Asst. to Supt. of Stations, St. Paul Gas Light Co.

Councilman, Halstad Powell
1908 M., 1909 M.E.
Willits, Cal.
Retired on account of ill health.

Countryman, Peter F. 1907 E.
Ontario, Ore.
Rancher, R. R. 1.

Couper, George B.
1893 M., 1902 M.E.
4811 33rd Ave. S. E., Portland, Ore.
Computer, Standard Appraisal Co.

Covell, Russell Oliver 1916 E.
55 Hanson Place, Brooklyn, N. Y.
Tel. Engr., Western Elec. Co., New York City.

Cowin, Clifford Cecil 1921 G.
3538 Blaisdell Ave., Minneapolis, Minn.
Salesman, Corwin & Co., Inc.

Cox, Richard Ferguson 1908 M.
Fort Mills, Corregidor, P. I.
Major, Coast Artillery, Washington, D. C.

Crabbe, George Norm 1904 E.
Cresskill, N. J.
Elec. Engr., Otis Elevator Co., New York City.

Craig, Robert 1897 M.
1575 N. Euclid Ave., Dayton, O.
Engr., Dayton Scale Co.

Cram, Clyde M. 1907 C.
725 Central Bldg., Los Angeles, Cal.
U. S. Asst. Engr., Los Angeles.

Crane, Eugene C.
1912 M., 1913 M.E.
8018 Germantown Ave., Chestnut Hill, Philadelphia, Pa.
Supt. of Constr. for Snow.

Crane, Fremont
1886 C., 1887 B.C.E., 1898 C.E.
Ft. McIntosh, Tex.
Civil Engr. and Supt. of Constr., Q. M. C., U. S. A.

Crawford, Allen Seymour 1912 M.
White Bear Lake, Minn., No. 2.
Sales Mgr., Webb Publ. Co., St. Paul.

Crawford, Wallace T. 1906 M.
1st Ave. and 5th St., Faribault, Minn.
Garage and welding shop.

Cray, Seymour R. 1922 C.
Danbury, Wisconsin.
Civil Engr., Northern States Power Co.

Cribbs, Harry Ernest 1923 C.
1161 E. Cook St., St. Paul, Minn.
Draftsman, Bridge Engineer's Office, N. P. Ry.

Critchett, Edward Fowler
1913 M., 1914 M.E.
4012 Vincent Ave. S., Minneapolis, Minn.
Instructor, Edison High School.

Croft, Edna Kathryn (Miss) 1922 A.
600 15th Ave. S. E., Minneapolis, Minn.
Draftsman, Croft & Boerner.

Croft, Ernest B. 1911 C.
1826 Park Ave., Minneapolis, Minn.
Croft & Boerner, Archts. and Engrs.

Crosby, Milton E.
1915 M., 1916 M.E.
395 Collins St., Melbourne Victoria, Australia.
Asst. Chief Engr., John S. Metcalf Co., Ltd.

Cross, Charles Henry 1897 M.
Room No. 401, 290 3rd St., Milwaukee, Wis.
Dist. Sales Superv., Mathews Eng. Co., Sandusky, O.

Cross, Roland E. 1923 M.
581 Portland Ave., Minneapolis, Minn.

Croswell, Daniel Robbins 1916 E.
Ironton, Minn.
Mgr., Cuyuna Range Power Co.

Croswell, Thomas LeRoy 1915 C.
Brainerd, Minn.
Vice President, Cuyuna Range Power Co.

Crounse, Avery Fitch 1903 G.
4323 Dupont Ave. S., Minneapolis.
Mgr., Sanitor Constr. Co.

Cuddy, William Arthur 1915 C.
3452 10th Ave. S., Minneapolis.
Traveling Auditor, Foreign Staff, Standard Oil Co., Madras, India.

Cummings, Elmer F.
1912 C., 1913 C.E.
224 Walnut St. S. E., Minneapolis.
Civil Engr., James Leck Co., Engrs. and Contrs.

Cunningham, Andrew Oswald, 1894 C.
6328 Washington Ave., St. Louis, Mo.
Cons. Engr., Wabash R. R.

Currie, Neill, Jr. 1908 E.
61 Taconic St., Pittsfield, Mass.
Engr., Power Motor Dept.

Curry, Byron K. 1923 C.
3208 Irving Ave. S., Minneapolis.
Constr. Engr., Fegles Constr. Co.

Curry, Ezra Benham
1920 M., 1921 M.E.
St. Paul, Minn.
C. M. & St. P. Ry. Co.

Curtis, Benjamin J., 1913 C., 1914 C.E.
473 Elm St., Blue Island, Ill.
Engr., T. J. Forschner Contracting Co., Chicago.

Curtis, Thomas Henry 1912 C.
1520 Harmon Place, Minneapolis.
Jones & Curtis, Fairmont, Minn.

Curtis, Verne F. 1922 M.
3009 Park Ave., Minneapolis, Minn.
Asst. Engr. to Ralph D. Thomas.

Curtiss, Lindsley Byron 1909 G.
1497 Branston St., St. Paul, Minn.

Cutler, Alvin S. 1905 C.
39 Barton Ave. S. E., Minneapolis.
Professor of Railway Engineering, University of Minnesota.

***Cutler, Henry Cleveland**
1894 M., 1895 M.E.

Cutter, Francis Charles 1905 M.
233 S. Jameson Ave., Lima, Ohio.
Asst. to Vice President, Lima Locomotive Works.

Czock, Jacob Henry 1920 M.
30 Chatham St., Cambridge, Mass.
Diesel Engr., on Exp. work, Worthington Pump & Machy. Corp.

Dahl, George 1921 A.
2227 Garfield Ave. S., Minneapolis.
Traveling abroad on Harvard Fellowship.

Dann, Wilbur Wainright 1890 C.
1258 Cypress Ave., San Diego, Cal.
Civil Engr. and Rancher, Ashland, Ore.

Danner, Jake 1901 E.
314 N. 5th Ave., La Grange, Ill.
Asst. Supt. of Production, Western Elec. Co., Chicago.

Darrell, James Engle Pandt 1923 C.
Danbury, Wisconsin.
Instrument man, Northern States Power Co.

Daum, Henry Arno 1912 E.
1649 Hague Ave., St. Paul, Minn.
Mgr. of Sales, Webb Publishing House.

Davies, Ralph M. 1909 E.
4304 So. Lyndale Ave., Minneapolis.
Grain Salesman, F. M. Davies Co.

Davis, Charles Asa 1905 E.
1764 Ashland Ave., St. Paul, Minn.
Partner in Davis-Reiners Paper Co.

Davis, Gilbert N. 1904 M.
345 Cleveland Ave. N., St. Paul.
Pressman, St. Paul Dispatch & Pioneer Press.

Davison, Joseph Henry 1903 C.
523 No. 4th St., Brainerd, Minn.
Engr. of Bridges and Buildings, M. & I. Ry. Co.

Dawley, William Sanborn 1879 C.
5657 Cabanne Ave., St. Louis, Mo.
Consulting Engr.

Dawson, John W. 1922 A.
3332 Grand Ave., Minneapolis.
Instructor in Architecture, University of Minnesota.

Deane, George Brooks 1919 A.
Ottumwa, Iowa.
Resident Architect on Y. W. C. A. for Croft & Boerner, Minneapolis.

De Freece, Paul K. 1923 C.
Sidney, Ia.

Dehn, Eltor Albert 1921 C.
763 Dayton Ave., St. Paul, Minn.
Toltz, King & Day, Engrs.

Del Plaine, Carlos Werter
1921 C., 1922 C.E.
6 Barton Ave. S. E., Minneapolis.
Chief Engr., Wm. M. Murphy & Son, St. Paul.

Demarest, Charles Sidney 1911 E.
75 Unadilla Road, Ridgewood, N. J.
Elec. Engr., American Tel. & Tel. Co., New York City.

Deneen, David Joseph 1919 A.
Grand Rapids, Minn.
Arch. Supt., Holstead & Sullivan, Duluth.

Deutsche, Richard Elliott 1918 C.
809 E. 14th St., Minneapolis, Minn.

Dever, Francis Albright 1920 C.
1228 E. First St., Duluth, Minn.
Draftsman, Duluth, Missabe & Northern Ry., Proctor.

Dewars, Allen Guthrie
1913 E., 1914 E.E.
3241 Minnehaha Ave., Minneapolis.
Electric Distribution Engr., St.

Dewey, William Harry 1893 E.
25 Hancock Place, New York City.

Diamond, Grover Willard 1912 C.
3137 Maury Ave., St. Louis, Mo.
Chief Draftsman, Stupp Bros. Bridge & Iron Co.

Dibble, Barry 1903 E.
American Falls, Idaho.
Project Mgr., U. S. Reclamation Service.

Didriksen, Philip Henry 1920 G.
67 E. Market St., Bethlehem, Pa.
Material Engr., Bethlehem Steel Co.

Dills, Lyle Alger 1921 G.
P. O. Box 23, Mound, Minn.
County Bridge Inspector and County Surveyor, Hennepin Co.

Dimond, Harvey G. 1914 C.
2016 Goodrich Ave., St. Paul, Minn.
Eng. Dept., G. N. Ry. Bldg.

Dindorf, Edward C. 1923 C.
769 Marshall Ave., St. Paul, Minn.
Des. & Est. Engr., Truscon Steel Co., Minneapolis.

Dinsmore, Arthur Thruston 1912 M., 1913 M.E.
3609 Crescent View Ave., West Duluth, Minn.
Industrial Engr., Klearflax Linen Looms, Inc.

Doell, Charles Edward 1916 C., 1917 C.E.
3254 15th Ave. S., Minneapolis.
Asst. to Secretary, Minneapolis Board of Park Commissioners.

Doeltz, William Fred, Jr. 1908 C.
305 Glen Ave., Portland, Ore.

Donahoe, Robert Emmet 1921 E., 1922 E.E.
Duluth, Minn.
Engr., Phoenix Utility Co.

Donaldson, Frank Arthur 1912 M.
4615 Emerson Ave. S., Minneapolis.
President, Donaldson Co., St. Paul.

Doolittle, William Y. 1914 C.
277 Wilder Ave., St. Paul, Minn.
St. Paul Water Dept.

Dorr, Wm. Ripley 1914 M.
320 No. Ardmore Ave., Los Angeles, Cal.
Vice President and Mgr., The Aeolian Co.

Dorrance, Albert Pellet 1912 E.
3420 Hennepin Ave., Minneapolis.
Salesman, The White Company.

Dorsey, John George 1915 C., 1916 C.E.
308 Selwood Bldg., Duluth, Minn.
Contractor, Pastoret Const. Co.

Dougan, Harry Knox 1908 C.
1315 Cleveland Ave., St. Paul.
Asst. Valuation Engr., Great Northern Ry. Bldg.

***Dougherty, Joe** 1907 C.

Douglass, Addison H. 1917 C., 1920 C.E.
3325 1st Ave. S., Minneapolis, Minn.
Ind. Sect., Mpls. Civic & Commerce Assn.

Douglass, Fred Luke 1891 C., 1899 C.E.
Covina, Calif.
City Engineer.

Dow, Clarence Arthur 1913 E., 1914 E.E.
205 So. Maple St., Pipestone, Minn.
Supt., Northwest Light & Power Co.

Dow, James Chase 1900 E.
104 Blackstone Apt., Great Falls, Mont.
Operating Engr., Montana Power Co.

Dow, William Gould 1916 E., 1917 E.E.
1621 Orrington Ave., Evanston, Ill.
Salesman, Westinghouse Elec. &

Dowd, Archie Joseph 1919 M.
739 Ridgeland Ave. N., Oak Park, Ill.
Development Engr., Western Elec. Co., Chicago.

Downie, John M. 1922 E.
242 Union St., Schenectady, N. Y.
Testman, General Electric Co.

Downing, Frank Eugene 1904 C.
414 So. 10th St., Gadsden, Ala.
Field Engr., The Cherokee Coal & Iron Co.

Dresser, Harry Samuel 1916 M.
2103 Colfax Ave. S., Minneapolis.

Drinkall, John Freeman 1919 E.
1265 E. 146th St., East Cleveland, O.
Exp. Engr., Nat'l Lamp Works.

Drinkall, Leon R. 1911 E.
105 Sheridan Ave. N., Minneapolis.
Head of Elec. Dept., Dunwoody Institute.

Drost, Henry Francis 1922 E.
5016 W. 24th St., Cicero, Ill.
Central Office Engr. Student, Western Elec. Co.

Duncan, George Robertson 1919 E.
4111 A. Terrace St., Oakland, Cal.
Salesman, Gen. Elec. Co., San Francisco.

Dunham, John A. 1907 C.
1411 Eastern Parkway, Schenectady, N. Y.
Railway Equipment Dept., Gen. Elec. Co.

Dunham, Roy Owen 1914 E., 1915 E.E.
1411 Eastern Parkway, Schenectady, N. Y.
Elec. Engr., Gen. Elec. Co.

Dunlap, Lemuel James 1917 E.
Cedar Rapids, Ia.
Sales Engineer, Ia. Ry. & Lt. Co.

Dunn, Andrew Paul 1906 E.
1334 Orange Grove Ave., Los Angeles, Calif.
Contractor.

Dunnavan, Ralph Burton 1923 E.
1154 Portland Ave., St. Paul, Minn.
Engr., St. Paul Gas Light Co.

Dunnum, Orney Emil 1922 E.
1114 West 1st St., Mansfield, O.
Designer of D. C. Machinery, Ideal Elec. & Mfg. Co.

DuToit, Geo. A. 1910 M.
4115 Dupont Ave. S., Minneapolis.
Treas., Northern Machinery Co.

***Dahl, Hans F. M.** 1898 E.

Dahl, Hjalmer A. 1922 E.
Westinghouse Club, Wilkinsburg, Pa.
Graduate Student, Westinghouse Elec. & Mfg. Co., Pittsburgh.

Dahlstrom, Raymond Esthon, 1910 E.
309 W. 52nd St., Minneapolis, Minn.
Dist. Toll Traffic Chief, N. W. Bell Telephone Co.

Dahlquist, Phillip Louis 1910 C.
732 S. Crescent Ave., Park Ridge, Ill.
Peterson-Dahlquist, Engrs., Chicago, Ill.

Dallimore, Arthur Norman 1908 C.
Fowler, Colo.
Engr. and Mgr., Apishapa Consolidated Irrigation Co.

Dally, Richard Timothy, Jr. 1921 C.
217 Dayton Ave., St. Paul, Minn.
Office Mgr., Paul J. Kalman Steel Co.

Damberg, Paul Siebert 1922 A.
710 Jones St., Eveleth, Minn.
Draftsman, E. H. Berg, Archt.

Damberg, Rheuben Penn 1921 A.
710 Jones St., Eveleth, Minn.
Draftsman, E. H. Berg, Archt.

Daniel, Thomas Lester 1900 M.
East Akron Sta., Box 706, Akron, O.
Eng. Dept., Goodyear Tire & Rubber Co.

Eberhardt, Otto Immanuel 1903 E.
543 Quincy Ave., Scranton, Pa.
President, Eberhardt Elec. Co.

Ebert, Solomon Bernard 1917 E.
2090 Berkeley Ave., St. Paul, Minn.
1st Lt. A. S. U. S. Army, Yale U., New Haven, Conn.

Eckenbeck, Evertt E. 1917 E.
6145 Woodland Ave., Chicago, Ill.
Whitacre-Gree Fire Proofing Co.

Eddy, Clarence J. 1922 M.
4218 Wentworth Ave., Minneapolis.
Pressman, Minneapolis Tribune.

Eddy, Horace T. 1895 E.
1322 N. 41st St., Omaha, Neb.
Instructor in Auto Mechanics, Omaha Tech. H. S.

Eddy, Lynne Walter 1907 E.
Cleveland, Ohio.

Edelman, Philip 1916 E., 1917 E.E.
1802 Hague Ave., St. Paul, Minn.

Eggers, Henry C. T. 1915 E., 1916 E.E.
2100 31st Ave. S., Minneapolis.
Asst. Prof. of Drawing and Descriptive Geometry.

Egilstud, Fridtjof Storjohan, 1920 M.
2200 Sheridan Ave. S., Minneapolis, Minn.
Stockland Road Machinery Co.

Eige, Elmer H. 1923 M.
4919 Washington Blvd., Chicago, Ill.
Technical Training Course, Western Elec. Co.

Ek, Gustaf Albin 1917 M.
2522 E. 24th, Minneapolis, Minn.

Ekberg, Carl E. 1914 C., 1915 C.E.
721 6th St. S. E., Minneapolis, Minn.
Draftsman, Bridge Dept., Northern Pacific Ry. Co.

Ekman, Claes Theodore 1910 C.
3833 11th Ave. S., Minneapolis.
Private practice, C. T. Ekman & Co., Engrs. and Archts.

Elfstrum, Axel Evold 1911 C.
2721 9th Ave., Oakland, Cal.
City Engr.'s Office, San Francisco.

Ellefson, Selmer 1916 E.
5045 Oliver Ave. S., Minneapolis.
Gen. Elec. Co.

Ellestad, Irwin Martin 1922 E.
509 Beacon St. S. E., Minneapolis.
Maintenance Dept., N. W. Bell Tel. Co.

Elliassen, Sigurd 1918 C.
147 Council Road, Tien-Tsen, China.
Acting Engr. in Charge, Survey Dept., Chili River Com.

Ellingson, Elmer 1916 C.
103 E. 16th St., Minneapolis, Minn.

Elliot, Harry Cass 1919 M.
5372 Iroquois Ave., Detroit, Mich.
Engr., Packard Motor Car Co.

Elliott, A. Douglass, 1914 E., 1915 E.E.
1710 Capitol Ave., St. Paul, Minn.
Elec. Engr., Charles L. Pillsbury Co., Minneapolis.

Ellison, Jay T. 1909 C.
2128 Lincoln Ave., St. Paul, Minn.
Asst. Commissioner, State Highway Commission.

Ellsworth, Charles De Roy 1920 E.
4624 So. 1st Ave., Minneapolis.
Sales Engineer, Century Elec. Co.

Elwood, Daniel H. 1923 E.
Decatur, Ill.

Elmer, Lloyd Armstrong 1921 M.
355 E. 21st St., Brooklyn, N. Y.
Test Engr., Western Elec. Co., New York City.

Elsberg, Nels William 1909 C.
1724 Portland Ave., Minneapolis.
City Engineer of Minneapolis.

Elstad, Rudolph Tilden 1919 C.
Coleraine, Minn.
Mining Engineer, Oliver Iron Mining Co.

Ely, Irving Robinson 1905 E.
226 St. James Place, Brooklyn, N. Y.
New York Navy Yard.

Emerson, Lynn Arthur 1911 E.
Joliet, Ill.
Supervisor, Vocational Education, Joliet Township H. S.

Emery, George Chase 1919 A.
25 South St., Waltham, Mass.
Frohman, Robb & Little, Archts., Boston.

Enger, Arne 1922 E.
2106 Dupont Ave. N., Minneapolis.

Enger, Edward Henry 1911 C.
3929 Bloomington Ave., Minneapolis, Minn.
Engr., Mpls. School Board, Court House.

Englin, Charles F. 1906 E.
Stillwater, Minn.
Sales and Credit Mgr., Connolly Shoe Co.

Engquist, Victor Emanuel 1920 E.
931 Clark St., St. Paul, Minn.
Engr., St. Paul Gas Co.

Engstrom, Elmer William 1923 E.
1 Willow Ave., Schenectady, N. Y.
Student Engr., Gen. Elec. Co.

Enke, Fred August 1921 C.
907 7th St., Brookings, S. D.
Asst. in Mathematics, South Dakota State College.

***Erf, John William** 1893 C.

Erickson, Carl Gunnard 1903 E.
6325 39th St. S. W., Seattle, Wash.

Erickson, Edwin C. O. 1922 C.
3137 29th Ave. S., Minneapolis.
Eng. Dept., Soo Line.

Erickson, Henry Anton 1896 E.
424 Harvard St. S. E., Minneapolis.
Prof. of Physics, University of Minnesota.

Espenett, Edward L. 1922 C.
New Brighton, Minn.

Esser, Frank F. 1909 C.
105 Lincoln St., Mankato, Minn.
Contractor.

Estep, Harvey Cole 1908 M.
2-3 Caxton House, Westminster, London, S. W. 1, Eng.
European Mgr., Penton Pub. Co., London, England.

Eustis, Irving Nelson
1917 M., 1918 M.E.
203 So. North Ave., Fairmont, Minn.
Asst. Engr., Fairmont Railway Motors, Inc.

Everett, William Rinehart
1914 E., 1915 E.E.
2949 Portland Ave., Minneapolis.
Bond Buyer, McNear Heeter Co.

Everington, James Wright 1901 C.
531 No. Louis St., Glendale, Calif.
Retired.

Fager, Simon Rudolph 1904 M.
4704 5th Ave. S., Minneapolis.
Western Heating Co.

Fahland, Frank, Jr. 1922 M.
411 12th Ave. E., Duluth, Minn.
Salesman, F. E. Christofferson Co., Inc.

Fairbanks, Geo. Wesley 1923 E.
4330 Minnehaha Ave., Minneapolis.
Sales Dept., Minneapolis Gen. Elec. Co.

Fairchild, Albert Royal 1907 E.
209 Cliveden Ave., Glenside, Pa.
Electric Service Supplies Co., Philadelphia.

Fallon, Eugene L.
1914 E., 1915 E.E.
52 Hereford St., Boston, Mass.
Engr., Elec. Div., Stone & Webster, Inc.

Farmer, John Wesley 1921 M.
2315 4th Ave. N., Minneapolis.
Estimator, Nott Contracting Co.

Farnam, Julian Perkins 1911 M.
4909 Garfield Ave. S., Minneapolis.
Architect, 753 Plymouth Bldg.

Fastenau, Karl De Vries 1916 E.
Address unknown; information requested.

Feder, Max 1922 C.
1016 Humboldt Ave. N., Minneapolis, Minn.

Fee, Ernest Franklin 1907 M.
1922 E. Superior St., Duluth, Minn.
Secretary and Treasurer, Zenith Cedar Co.

Felton, Ralph Potter 1892 M.
4815 Queen Ave. S., Minneapolis.
Field Agent, Greater Minnesota Assn.

Feeney, Wayne I. 1923 E.
1103 5th St. S. E., Minneapolis.
Legal Valuation Dept., G. N. Ry., St. Paul.

Fernald, Frank Osborne 1904 C.
3801 Normandy St., Dallas, Texas.
Supt. (Operating Dept.) The Pullman Co.

Feyder, William Henry 1905 C.
1152 Churchill St., St. Paul, Minn.
Asst. Engr., N. P. Ry. Co.

Fieldman, David Pinkus 1911 C.
617 58th Ave. W., Duluth, Minn.
Ladies' Furnishings.

Finke, Walter J. 1910 E.
Charles City, Ia.

Finley, Joseph Edward 1905 C.
2314 Bryant Ave. S., Minneapolis.

Fischer, Harold W. 1923 E.
4210 Dupont Ave. N., Minneapolis.
Com'l Engr., Northwestern Bell Tel. Co.

Fiske, Harold Collins 1922 E.
1685 Hague Ave., St. Paul, Minn.
Elec. Engr., J. E. Sumpter Co.

Fiske, Frederick William, Jr., 1909 C.
2 White Bear Lake, Minn.
Engineer, Geo. Grant Construction Co., St. Paul.

Fitts, Joel Archer 1909 E.
7441 N. Maplewood Ave., Chicago, Ill.
Engr., Electric Storage Battery Co.

Finchy, Jacob Oscar 1906 E.
Address unknown; information requested.

***Fitzgerald, Patrick Thomas** 1885 C.

Fleming, Douglas R. 1908 C.
Marreno, La.
Land and cattle business.

Fleming, Frank R.
1908 M., 1909 E.E.
115 N. Fairview, St. Paul, Minn.
Valuation Engr., Pacific Railway.

Fleming, Laurence Trent 1910 M.
105 La Fonda Ave., Santa Cruz, Cal.
Asst. Engr., U. S. Railroad Administration, Washington, D. C.

Flindt, Richard H. 1923 C.
Mason City, Iowa.
Supt. of Const. on Harding High School for Croft & Boerner, Minneapolis.

Flygare, August Leroy 1912 C.
614 So. Mill St., Fergus Falls, Minn.
Division Engineer, Minnesota Highway Dept.

Foltz, Ross Milton 1919 M.
587 14th Ave., Wauwatosa, Wis.
Sales Engineer, Obenberger Forge Co., West Allis.

Forbes, Henry C. 1922 E.
212 E. 34th St., Minneapolis, Minn.

Ford, Robert E. 1895 E., 1903 E.E.
2617 Humboldt Ave. S., Minneapolis, Minn.
Partner, Luther Ford & Co.

Forfar, Donald M. 1909 M.
3345 Harriet Ave., Minneapolis.
Mech. Engr., Croft & Boerner, Inc.

Forsberg, Elmer John
1921 M., 1922 M.E.
716 Beacon St., Minneapolis, Minn.
Engr., St. Paul Gas Co., St. Paul.

Forsberg, Enock E. 1918 A.
3729 13th Ave. S., Minneapolis.
Draftsman, F. M. Mann.

Forsberg, Peter William 1911 E.
Grosvenor Square, Schenectady, N. Y.
Railway Equip. Eng. Dept., Gen. Elec. Co.

Forssell, William O. 1922 G.
3024 University Ave. S. E., Minneapolis, Minn.
Yardman, Brooks Bros., Inc., St. Paul.

Fortune, Harry G. 1920 M.
4053 Walker, Toledo, Ohio.
Industrial Training Dept., Factories Bldg.

Fossen, George 1911 C.
2113 Chicago Ave.
Partner, Fred R. Comb Co., Gen. Contrs.

Frahm, Alfred Richard 1908 E.
308 8th St. S., Fargo, Ill.
Engr., Northern States Power Co.

Francis, Paul Edgerton 1918 M.
909 W. Franklin Ave., Minneapolis, Minn.
Field Engr., Northwestern Fuel Co., St. Paul.

Frankoviz, John Joseph 1905 E.
Fergus Falls, Minn.
Pres., Frankoviz Hardware Co.

***Frary, Hobart Dickinson** 1908 M.

Fraser, Charlisle Gilman 1922 C.
1836 Marshall Ave., St. Paul, Minn.
Engr., Wm. C. Fraser, Engr.

Fraser, George 1919 A.
Ithaca, New York
Asst. Prof. of Arch., Cornell Univ.

Frear, J. B. 1910 M.
Taft Place, 45th St., Buffalo, N. Y.
Mech. Eng., American Radiator Co.

Frederickson, Harry B. 1911 E.
1213 Long Ave., Hillside, N. J.
Asst. Plant Engr., Public Service Elec. Co., Newark.

French, Edwin Linton 1902 E.
5 Burns Ave., Niagara Falls, Ontario.

Friar, Floyd M. 1920 C.
925 6th St. S. E., Minneapolis, Minn.

Friedman, Edwin A. 1923 E.
315 Garfield St., Hibbing, Minn.
Constr. Foreman, Oliver Iron Mining Co., Virginia.

Frost, Herbert Johannes 1922 C.
Engineer's Camp at Garden Lake, Winton, Minn.
Instrument man, R. D. Thomas, Minneapolis, Minn.

Fruen, Arthur Bernard
1908 G., 1909 C.E.
57 Oliver Ave., Bryn Mawr, Minneapolis, Minn.
Pres. and Treas., Fruen Cereal Co.

Furber, Pierce Powers 1908 C.
2058 Carroll Ave., St. Paul, Minn.
Constr. Engr., Louis F. Dow Co.

***Furber, Pierce Powers, Sr.** 1879 C.

Gadsby, Lester Hunter 1909 E.
807 So. Encina St., Visalia, Calif.

Gage, Hugh Newton 1908 C.
4216 Linden Hills Blvd., Minneapolis, Minn.
Engr., State Highway Dept., St. Paul.

Gammell, John Henry 1914 M., 1915 M.E.
616 11th Ave. S. E., Minneapolis, Minn.
Oculist and Aurist.

Gannell, Danforth King 1916 E., 1917 E.E.
147 25th St., Elmhurst, N. Y.
Tel. Engr., A. T. & T. Co., New York City.

Garber, Gabriel Everett 1906 M.
4201 Colfax Ave. S., Minneapolis, Minn.
Broker in Iron and Steel.

Garen, George M. 1910 C.
1055 Laurel Ave., St. Paul, Minn.
Asst. Supt. of Constr., Dept. of Public Works.

***Garvey, Walter S.** 1915 E., 1916 E.E.

Gee, Harry James 1919 G.
517 So. 10th St., Minneapolis, Minn.
G. E. Gee Grain Co.

Gerlach, Arthur C. 1917 M.
32 Hickory Ave., Takoma Park, Maryland.
Mech. Draftsman, Bureau of Yards & Docks, Washington, D. C.

Gerlach, Henry C. 1922 A.
Mankato, Minn.
Architect.

Gerow, Theron Gardner 1920 M.
2517 Bryant Ave. S., Minneapolis, Minn.
Engr., Republic Coal Co.

Gerrish, Harry Eldon 1905 M.
4618 Colfax Ave. S., Minneapolis, Minn.
Pres., Morgan Gerrish Co.

Gerry, Martin Hughes, Jr. 1890 M., 1891 E.
Leamington Hotel, Minneapolis.

Gessert, George Richard 1907 M.
1671 Harvester Ave., St. Paul.
Estimator, Dept. of Public Works.

Gewalt, Carl Henry 1921 A.
31 E. 39th St., New York City.
Archt., Carnegie Hall.

Gibbs, Clayton Tupper 1918 E.
215 East Bay State Ave., Alhambra, Calif.
Elec. Designer, Holmes & Sanborn, Los Angeles, Cal.

Gibson, Charles Bradley 1905 E.
1656 Denniston Ave., Pittsburgh, Pa.
Mgr., Westinghouse Elec. & Mfg. Co.

Giertsen, Marcus Oliver 1912 C., 1913 C.E.
4101 East 34th St., Minneapolis, Minn.
Asst. Bridge Engr., Minnesota Highway Commission.

Gilbert, Roy 1920 C.
1015 E. Huron St., Ann Arbor, Mich.
Medical Student, University of Michigan.

Gilchrist, Charles Chandler 1898 E.
Western Electric Co., Hawthorne Sta., Chicago, Ill.

Gill, James Herbert 1892 M., 1894 M.E.
728 University Terrace, Morgantown, W. Va.
Prof. of Machine Const., University of W. Va.

Gillette, George Lewis 1905 C.
2614 Irving Ave. S., Minneapolis, Minn.
Vice Pres., Minneapolis Steel & Machinery Co.

***Gillette, Lewis Singer** 1876 C., 1898 C.E.

***Gilman, Fred H.** 1890 C.

Gilman, Howard Bertram 1917 A.
3417 Park Ave., Minneapolis, Minn.
Archt.

Gilman, James Beatty 1894 C.
5114 So. Lyndale Ave., Minneapolis, Minn.
Chief Engr., Minneapolis Steel & Machinery Co.

Gilman, Nicholas A. 1907 M.
Yakima Valley Transp. Co., No. Yakima, Wash.

Gilstad, Arthur 1923 M.
681 Jenks St., St. Paul, Minn.
Cost Acct., Standard Conveyor Co.

Giltiman, David Murray 1915 M., 1916 M.E.
1223 Virginia St., Charleston, W. Va.
Asst. Sales Mgr., Eskew, Smith & Cannon, Wholesale Hardware.

Gjesdahl, Maurice Sven 1921 M.
3123 14th Ave. S., Minneapolis.
Statistical Engr., Board of Education.

Glascock, Henry Hopson 1906 E.
New London, Mo.
Prop. and Gen. Mgr., New London Tel. Co.

Glass, Clifton Ashley 1898 C.
St. Regis Hotel, Kansas City, Mo.
Sales Mgr., Kansas City Structural Steel Co.

Godward, Alfred Calvin 1910 C.
4621 Vincent Ave. S., Minneapolis.
City Planning Engineer.

Goebel, Rudolph Conrad 1913 E., 1914 E.E.
706 Essex St. S. E., Minneapolis, Minn.
Mech. Engr., Andrews Heating Co.

Goetzenberger, Ralph Leon 1913 E., 1914 E.E.
4623 Morris St., Germantown, Philadelphia, Pa.
Mech. Engr., U. S. A. Frankfort Arsenal.

Goldberg, Maurice Gordan 1923 E.
711 Dayton Ave., St. Paul, Minn.
Owner, Beacon Radio Service.

Goodkind, Leo 1892 A.
40 Grocus Place, St. Paul, Minn.
Sec. and Treas., Mannheimer Bros.

Goodwin, Victor Earl 1904 E.
27 Holmes Road, Pittsfield, Mass.
Elec. Engr., General Elec. Co.

Goss, Harold R. 1920 E.
125 W. 2nd St., Mansfield, O.
The Ideal Electric & Mfg. Co.

Gould, Edward Spalding 1920 C.
500 Delaware St. S. E., Minneapolis, Minn.
City Assessor's Office.

***Gould, Reed Douglas** 1918 C.

Graf, Donald T. 1922 A.
1915 Hennepin Ave., Minneapolis, Minn.
Draftsman, Silas Jacobson, Archt., St. Paul.

Graham, Eugene Clayton 1902 G.
R. F. D. No. 3, Evansville, Ind.

Graling, Verney 1899 E.
540 12th St., Niagara Falls, N. Y.
Operating Dept., Niagara Falls Power Co.

Grant, E. R. 1924 C.
601 East High St., Jefferson City, Mo.

Grant, Fred R. 1909 E.
13 Irving Road, Scotia, N. Y.
General Elec. Co., Schenectady, N. Y.

Grant, James Allen 1907 C.
Address unknown; information requested.

Gray, William Irving 1892 E., 1898 E.E.
2102 Lake of Isles Blvd., Minneapolis, Minn.
W. I. Gray & Co., Electrical Contractors.

Greeley, George Alfred 1913 C., 1914 C.E.
Care Mrs. J. L. Doubleday, 909 Platt St., Tampa, Fla.

Green, Fred H. 1907 C.
671 Ulloa St., San Francisco, Calif.
Secy. and Treas., Atlas Heating & Ventilating Co.

Greenberg, Jack 1922 C.
5120 Bryant Ave. S., Minneapolis, Minn.

Greenberg, Morris 1918 M.
515 Capitol Blvd., St. Paul, Minn.
Mech. Engr., Bailey Meter Co., Cleveland, Ohio.

Greenwood, Williston Wirt 1890 C.
2529 Gleason Ave., Los Angeles, Calif.

Gregg, Tresham Dames 1905 C., 1906 C.E.
165 Broadway, New York City.
Gregg & Co., Newark, N. J.

Grettum, Le Roy A. 1923 E.
Winona, Minn.
Elec. Engr., Wis. Ry. Lt. & Power Co.

Grime, Edwin Norrell 1900 C.
1341 11th Ave., Fargo, N. D.
Supervisor, Bridges & Bldgs., N. P. Ry. Co.

Grimes, David 1919 E.
No. 1 Windermore Road, Durkee Manor, Grasmere, N. Y.
Vice Pres., Grimes Radio Eng. Co., New York City.

Grimshaw, William Elwood 1902 M.
Hotel Washington, Seattle, Wash.
Real Estate.

Groat, Benjamin Feland 1901 G.
6306 Woodbine Ave., Philadelphia, Pa.
Consulting Engineer.

Grochau, Earl Henry 1921 C.
24 So. Front St., Memphis, Tenn.
Cost Engr., Gauger, Korsmo Constr. Co.

Groth, Arthur William 1920 E.
331 North Grove Ave., Oak Park, Ill.
Circuit Engr., Western Electric Co., Chicago.

Grow, Harry Allen 1903 C.
53 Seymour Ave. S. E., Minneapolis, Minn.
Asst. Chief Engr., Minneapolis Steel & Machinery Co.

Grow, Robert Walker 1916 C.
Champaign, Ill.
Captain, Cavalry U. S. A., University of Illinois.

Guesmer, Geo. Otto 1923 C.
Danbury, Wisconsin.
Draftsman, Northern States Power Co.

Gussisberg, Charles F. 1917 M.
1231 Oliver Ave. N., Minneapolis, Minn.

***Gunnerson, Carl A.** 1914 E.

Gunstad, Paul Iver 1901 C.
Detroit, Minn.
County Highway Engr., Becker County, Minn.

***Gunther, August N.** 1906 E.

Guthrie, John De Mott 1893 E.
3669 Interlake St., Seattle, Wash.
Physician.

Haeberle, Elmer Harvey 1906 E.
New Ulm, Minn.
Mgr., New Ulm Ice Co.

Haberle, Edward L.
1912 C., 1913 C.E.
1310 Emerson Ave. N., Minneapolis.
Estimator and Structural Designer, Bridge Dept., G. N. Ry., St. Paul.

Hagelin, Lawrence Waldemar, 1922 E.
1401 Russell Ave. N., Minneapolis.

Hagerman, Oliver Summers 1918 M.
79 Mackubin St., St. Paul, Minn.
Distribution Engr., St. Paul Gas Light Co.

***Hagstrom, Herbert E.** 1910 E.

Hahn, Stanley W. 1922 A.
1711 University Ave. S. E., Minneapolis, Minn.
Draftsman, Colburn & Forsell, Archts. and Engrs.

Haines, Allen Kellogg 1913 E.
702 Eastgate Ave., St. Louis, Mo.
Sales manager, The Dick X-Ray Co.

Haines, Howard N. 1922 A.
Oakland, Ia.
Principal, Public School.

Halden, Herbert Oliver 1923 M.
215 N. 5th Ave., Virginia, Minn.
Asst. to Efficiency Engr., Minn. Power & Light Co.

Halladay, Leslie Llewellyn 1921 C.
1320 7th St. S. E., Minneapolis.
Field Aide, City Planning Commission.

Hallan, Christian 1902 C.
3933 Blaisdell Ave., Minneapolis.

Hames, Henry Clay 1911 E.
955 St. Clair St., St. Paul, Minn.
Supt. of Icing Facilities, N. P. Ry.

Hamilton, Jefferson Merritt 1919 A.
134 W. 49th St., Minneapolis, Minn.

Hamlin, Lehan Hamer
1921 M., 1922 M.E.
4422 Colfax Ave. S Minneapolis.
Power Plant Assistant, Twin City Rapid Transit Co.

Hammerstrom, Aleck Adelord
1921 E.
3717 Rendle Ave., Duluth, Minn.
N. W. Bell Tel. Co.

Hammett, Ralph Warner 1919 A.
Mankato, Minn.
Touring Europe on Nelson-Robinson Traveling Fellowship.

Hammond, Laurence D.
1914 M., 1915 M.E.
2015 Aldrich Ave. S., Minneapolis.
Mech. Equipment Contractor.

Hanauer, Monroe H. 1906 C.
108 Maryland Apartments, Salt Lake City, Utah.
Branch Manager, Minneapolis Steel & Machinery Co.

Handschu, C. E. 1915 C.
Mora, Minn.

Hanke, Carl C. 1920 C.
1326 Estes Ave., Chicago, Ill.
Draftsman and Designer, Ill. Central R. R.

Hankenson, John Jay 1892 C.
Glencoe, Minn.
Contractor, Ajax Dredge Co.

Hanrahan, Edmond Constantine
1920 G.
Morris Minn.
Asst. City Engr., Faribault, Minn.

Hansen, Carlos C. 1920 C.
Rushford, Minn.
Field Draftsman, Minn. Highway Dept.

Hansen, Christian Jr. 1910 E.
1695 Summit Ave., St. Paul, Minn.
Asst. Auditor, Mpls. General Elec. Co., Minneapolis.

Hansen, Edwin Lewis 1921 C.
5692 Ash St., Los Angeles, Calif.
Estimator, Geo. L. Eastman Co.

Hansen, Maurice James 1911 E.
3615 Stevens Ave. S., Minneapolis.
Marketing Asst., Vacuum Oil Co.

Hargraves, Robert Avery 1923 E.
1820 Woodland Ave., Duluth, Minn.
Wireman, Minnesota Steel Co.

Harris, Clayton 1909 E.
Lyndenwood Ave., Dallas, Texas.

Harris, Harold Russel
1914 E., 1915 E.E.
731 Osceola Ave., St. Paul, Minn.
1123 Met. Life Bldg., Mpls.
Elec. Manufacturer's Agent.

Harris, Nathan 1920 G.
3452 Girard Ave. So., Minneapolis.
Draftsman, City Planning Comm.

Harris, Sigmund 1905 M.
3217 Holmes Ave., Minneapolis, Minn.
Pres., Harris Mchy. Co.

Hartig, Henry Edward 1918 E.
Robbinsdale, Minn.
Instructor in Mathematics and Mechanics, University of Minnesota.

Hartman, Walter King 1919 E.
3210 Arthinton St., Chicago, Ill.
Sales Engr., Century Elec. Co.

Hartney, James L. 1914 M., 1915 M.E.
600 N. E. 2nd St., Minneapolis.
Mgr., Tractor Sales, Owens Motor Sales Co., St. Paul.

Hartzberg, Edward Maxwell 1919 M.
1125 Thomas Ave. No., Minneapolis.
Concrete Engr., Los Angeles Gas & Elec. Co., Los Angeles.

Harwood, Stanley Gordon 1908 M.
3136 Elliott Ave., Minneapolis, Minn.
Treas., Winget Kickernick Co.

Hastings, Clive 1896 M.
317 Laramie St., Atchison, Kans.
Pres., The Railway Specialty Co.

Haverson, Henry David 1907 C.
Address unknown, information requested.

Hawkins, Harvey Carroll 1923 E.
623 26th Ave. No., Minneapolis.
Switchboardman, Northwestern Bell Tel. Co.

Hawley, Harry Garfield 1907 C.
Address unknown, information requested.

Hawlik, Henry Irwin 1919 C.
401 Caswell Block, Milwaukee, Wis.
Engr., Fidelity Phoenix Fire Ins. Co., Chicago.

Hayden, John Foot 1890 C.
1920 Irving Ave., Minneapolis, Minn.
Mang. Editor, Mississippi Valley Lumberman.

Hayes, Edward James 1920 M.
1621 Thomas Place, Minneapolis.
Erecting Engineer, J. G. Robertson, St. Paul

***Haynes, Stanley H.** 1915 C.

Haynes, S. H. 1915 G.
Address unknown, information requested.

Hayward, George Irving 1906 C.
1295 Goodrich Ave., St. Paul, Minn.
Asst. Dist. Engr., N. P. Ry. Co.

Hayward, Lawrence William 1921 E.
Engr., Benjamin Engineering Co., Cleveland, Ohio.

Heath, Donald Campbell 1916 A
43 Dell Place, Minneapolis, Minn.
Architect.

Hedenstrom, Ernest Axel 1912 E.
1441 Van Buren St., St. Paul Minn.

Heidelberger, Otto F. 1923 E.
1110 Sixth St. S. E., Minneapolis.
Teaching Fellow in Electrical Engineering, University of Minnesota.

Heidelberger, Roy Jacob 1922 E.
Wheaton, Minn.

Heinemann, John Robert 1919 E.
27 Chestnut St., Schenectady, N. Y.
Designing Engr., General Elec. Co.

Hektner, Joel 1917 M.
Apt. 2, 3300 Palmer St., Chicago, Ill.
Asst. Engr., Freight Car Design, C. M. & St. P. Ry.

Helmick, Dan S. 1915 C.
939 14th Ave. S. E., Minneapolis.
Hydraulic Engr., with R. D. Thomas, Cons. Engr.

***Helms, Frank Charles** 1904 E.

Helwig, William Frank 1923 E.
4308 West 22nd St., Chicago, Ill.
Student Engr., Western Elec. Co.

Hemsey, Clayton E. 1922 M.
12 Maiden Lane, Raleigh, N. C.
Designer, Carolina Power & Light Co.

Hendrickson, Arnold Benard 1922 E.
960 Idaho Ave., Sawtelle, Calif.

***Hendrickson, Eugene Alvin** 1876 C.

Hendrickson, Norman Everard
1916 C.
4715 16th Ave. So., Minneapolis.
P. J. Kalman Steel Co., St. Paul.

Henry, Burt Charles 1921 C.
1985 Portland Ave., St. Paul, Minn.
Estimator, Gauger & Korsmo Const. Co.

Herrick, Carl Albert 1902 M.
4120 Sheridan Ave. So., Minneapolis, Minn.
Asst. Prof. of Mathematics and Mechanics, University of Minnesota.

Herrmann, Raymond Russell
1912 E., 1913 E.E.
2255 Gordon Ave., St. Paul, Minn.
Asst. Prof. of Math. and Mech., University of Minnesota.

Hethterton, Percival 1908 M.
Great Falls, Minn.

***Hewett, Frank M.** 1897 C.

Hewett, Maurice William
1913 C., 1914 C.E.
521 Como Ave. S. E., Minneapolis.
Engr., City Engr's Office, St. Paul.

Hibbard, Sheldon Sampson 1923 M.
1722 Jefferson St., Duluth, Minn.
Engr. and Estimator, Clyde Iron Works.

Hibbard, Truman 1897 E.
4816 Penn Ave. S., Minneapolis, Minn.
Sec. and Chief Engr., Elec. Machinery Co.

Hickok, Jessie E. Stevens
1896 G., 1904 M.S.
Minneapolis, Minn.
Treas., Hickok Construction Co.

Higgins, Charles Campbell 1900 M.
Address unknown, information requested.

Higgins, Elvin Lydiard 1892 C.
Hutchinson, Minn.
Civil Engr.

Higgins, John T. 1890 C., 1894 M.D.
Address unknown, information requested.

Hildebrandt, Henry A. G. 1899 E.
323 Church St. S. E., Minneapolis.
Supt. of Bldgs. and Grounds, University of Minnesota.

Hilferty, Charles Dutton 1896 M.
647 Prospect St., Westfield, N. J.

Hill, Hibbert M. 1923 C.
Jr. Engr., U. S. Coast & Geodetic Survey, Washington, D. C.

Hillman, Charles Kirk 1912 E.
Address unknown, information requested.

Hirleman, Clark William
1912 M., 1913 M.E.
4424 Washburn Ave. S., Minneapolis, Minn.
Mech. Director of City Hospitals.

Hoag, William Ricketson 1884 C., 1888 C.E.
1219 4th St. S. E., Minneapolis, Minn.

Hobart, Walter Beal 1907 C.
2103 Colfax Ave. S., Minneapolis, Minn.
Civil Engr.

Hodnett, Ralph Meyerhodd 1911 C.
1516 West Minnehaha, St. Paul.
Water Dept.

Hoff, Christopher 1906 E.
65 E. Water St., St. Paul, Minn.
Vice Pres., Lee-Hoff Mfg. Co.

Hoffman, Michael J. 1911 C.
1079 Hawthorne St., St. Paul, Minn.
Asst. Maintenance Engr., State Highway Comm.

Hoffman, Richard Harold 1923 M.
Bartlesville, Okla.
Auto Service Dept., The Empire Companies.

Hokanson, Clarence E. 1906 E.
31 Cambridge St. East Orange, N. J.

Holien, Edward Obert 1923 A.
1030 Broadway St., Fargo, No. Dak.
Instructor in Arch., No. Dak. Agricultural College.

***Holland, Jay Clark** 1904 C.

Holm, Edwin R. 1920 C.
213 So. Barstow St., Eau Claire, Wis.
Engr. and Inspector, Wis. Highway Commission.

Holmberg, Abner Waldo 1915 M., 1916 M.E.
134 W. Aurora St., Ironwood, Mich.
Engr., McKinney Steel Co., Bessemer.

Holmgren, Charles E. 1909 M.
Kenmare, N. D.
Instructor, Kenmare H. S.

Holmstine, Arthur G. 1917 M.
134 W. Belvidere St., St. Paul, Minn.

Holmstine, Victor Theodore 1922 M.
134 W. Belvidere St., St. Paul, Minn.
Cadet Engr., St. Paul Gas Light Co.

Hoorn, Frederick Wilhelm 1912 E., 1914 E.E.
Ann Arbor, Mich.
Capt., Signal Corps, U. S. Army, University of Michigan.

Hopeman, Albert Manus 1905 C.
922 18th St. S., Moorhead, Minn.
Pres., Hopeman Material Co.

Hopkins, Mark L. 1909 E.
R. R. No. 1, Minneapolis, Minn.
Bureau of Bldgs., Mpls. Board of Education.

Hoppin, Glenn H. 1908 E.
146 Davison Ave., Highland Park, Mich.

Hornibrook, James W. 1909 E.
900 Dakin St., Chicago, Ill.
Sales Dept., Westinghouse Lamp Co.

Horstkotte, Arthur E. 1922 C.
Fresno, Calif.
Supt. of Constr., Sugar Pine Lumber Co.

Hosfield, Raleigh William 1912 C.
Faribault, Minn.

Hosmer, Orville, H. 1923 C.
1285 James St., St. Paul, Minn.
Asst. Civil Engr., City Planning Dept.

Hotchkiss, Fred Wesley 1918 E.
Minneapolis, Minn.
Sales Engr., Elec. Machinery Mfg. Co.

Hougan, Sander 1921 E.
1304 7th Ave. N., Great Falls, Mont.

***Houghtaling, Elting W.** 1915 E., 1916 E.E.

Houlton, Amos Dwight 1901 E.
1310 Clinton Ave., Minneapolis.
Plating & Grinding Press Rolls, Minneapolis Tribune.

Houston, Cecil C. 1909 C.
226 Madison St., Wheaton, Ill.
Chief Clerk, Office of President, C. & N. W. Ry.

Houston, George S. 1902 C.
3833 Thomas Ave., Minneapolis.
Stock and Bond Salesman.

Houts, Guy Joseph 1901 E.
1118 So. Clinton Ave., Oak Park, Ill.
Tel. Engr., Western Elec. Co., Chicago.

Hovden, Conrad D. 1912 E., 1913 E.E.
Perley, Minn.
Asst. Chief Engr., Swift & Co., St. Paul, Minn.

***Hovelson, Henry** 1908 E.

Howard, Monroe Sherman 1892 E.
Waukon, Ia.

Howatt, John 1904 E.
7227 Oglesby Ave., Chicago, Ill.
Chief Engr., Board of Education.

Hoyt, Hiram Patrick 1893 C.
1675 Marin Ave., Berkeley, Calif.
Contract. Engr., Monadnoch Bldg., San Francisco, Cal.

Hoyt, William Hausmer 1890 C., 1898 C.E.
313 21st Ave. E., Duluth, Minn.
Chief Eng., D. M. & N. Ry.

Hubbard, Fred A. 1909 C.
Address unknown, information requested.

Hubbard, Henry A. 1909 C.
1433 W. 32nd St., Minneapolis, Minn.
Cashier, American State Bank.

Hubbard, Robert Thorold 1906 E.
2602 Gregory St., Madison, Wis.
Asst. Consult. Engr., Ross W. Harris.

Hubbell, Arthur C. 1914 M., 1915 M.E.
7443 Paxton Ave., Chicago, Ill.
Supt., American Can Co.

Hughes, Frank Charles 1903 M.
312 Washington Blvd., Oak Park, Ill.
Pres., Lewis Hughes Co., & Airlox Rubber Co., Chicago.

***Hugo, Victor** 1896 M.

Huhn, George Philip 1891 E.
319 12th Ave. S. E., Minneapolis.
Real Estate and Insurance.

Hult, George Albert 1916 E.
718 W. 8th St., Sioux Falls, So. Dak.
Gen. Supt., Northern States Power Co.

Hunt, Gates Ensign 1920 E.
264 Union St., Hackensack, N. J.
Sales Engr., Cutler Hammer Mfg. Co.

Huntoon, Milton B. 1899 E.
320 Virginia Ave., Detroit, Mich.
Tel. Engr., Bell Telephone Co.

Hustad, Andrew P. 1909 C.
4132 Aldrich Ave. S., Minneapolis.
Consult. Engr.

Hustad, Byron P. 1910 E.
125 Waverly Place, Duluth, Minn.
Gen. Contr., B. P. Hustad Co.

Hustad, John C. 1914 C., 1915 C.E.
4704 Aldrich Ave. S., Minneapolis, Minn.
Pres., The Hustad Co., Consult. Engrs.

Huston, David Bartholomew 1907 C.
143 14th Ave. N. E., Minneapolis, Minn.

Hvoslef, Fredrik Waldemar 1917 M., 1919 M.S.
50 W. Euclid Ave., Detroit, Mich.
Asst. Chief Engr., U. S. Radiator Corp.

Ingberg, Simon 1909 C.
Washington, D. C.
Physicist, Bureau of Standards, U. S. Dept. of Commerce.

Ireland, Roy R. 1903 E.
31 Cambridge St. E., Orange, N. J.
Engr., Western Electric Co., New York, N. Y.

Irwin, Frank Harold 1916 E., 1917 E.E.
4013 12th Ave. S., Minneapolis.
Estimator, Pierson-Wilcox Electrical Co.

Irwin, Vincent Herbert 1913 E., 1914 E.E.
139 Queen Ave. N., Minneapolis, Minn.
Asst. Chief Engr., Steam Station, Minneapolis Street Ry. Co.

Jackson, Earl Daniel 1905 E.
655 Portland Ave., St. Paul, Minn.
Cons. Engr., 403 Endicott Bldg.

Jackson, Otto Emanvel 1914 E., 1915 E.E.
Eureka, S. D.
Mgr., Sterling Oil Co.

Jacobs, Arthur R. 1917 E.
604 Holly Ave., St. Paul, Minn.

Jacobson, Howard Carey 1921 G.
1085 24th Ave. S. E., Minneapolis.
Manager, Engineers' Bookstore, University of Minnesota.

James, Henry Clay 1911 E.
955 St. Clair St., St. Paul, Minn.
Asst. Supt., Telegraph Dept., N. P. Ry.

Janzen, William Henry 1920 E.
Mountain Lake, Minn.
Foreman, C. M. & St. P. R. R., Avery, Idaho.

Japs, Barney George 1909 E.
522 W. 21st St., University Place, Nebr.
Dairy and Poultry Business.

Jaques, Robert 1909 C.
108 W. Victoria, Duluth, Minn.
Lawyer, Jaques & Hudson.

Jensen, Cyril Dewey 1921 C.
Minneapolis, Minn.
Care Northern States Power Co.

Jensen, John Arthur 1905 C.
4219 Pleasant Ave., Minneapolis, Minn.
Supervisor, City Water Works Dept.

Jesperson, Clarence M. 1910 E.
112 E. 5th St., Anniston, Ala.
Secy. and Treas., Federal Phosphorus Co.

Jevne, Geo. W. 1910 C.
847 N. Coronado St., Los Angeles, Calif.
Engr., Speers-Jevne, Reinforced Concrete Design and Sales.

Joachim, Wm. P. 1920 M.
76 Sycamore Ave., Box 214 B, R. F. D. No. 4, Hampton, Va.
Engr., National Advisory Committee for Aeronautics.

Johnson, Albert Warren 1923 C.
4513 Greenview Ave., Chicago, Ill.
Draftsman, Kalman Steel Co.

Johnson, Alexander B. 1915 C.
Maynard, Minn.

Johnson, Alphonse Nels 1921 C.
421 So. College St., Springfield, Ill.
Engr., Bureau of Bridges.

Johnson, Austin G. 1905 M.
Box 613, Two Harbors, Minn.
Mech. Engr., D. & I. R. R. R.

Johnson, Byron Fillmore 1920 C.
Marine Barracks, Washington, D. C.
First Lieut., U. S. Marine Corps.

Johnson, Carl Albert 1921 M., 1922 M.E.
83 Como Ave., St. Paul, Minn.

Johnson, Carl Arthur 1911 C.
1600 15th St., Denver, Colo.
Branch Mgr., Minneapolis Steel & Machinery Co.

Johnson, Carl J. 1914 E., 1915 E.E.
La Moure, N. D.
Local Mgr., Dakota Utilities Co.

Johnson, Carl Sigfrid 1921 C.
133 Kenefic Ave., Buffalo, N. Y.
Detailer, Lackawanna Bridge Corp.

Johnson, Edgar Frederick 1921 E.
502 E. Wood St., Waseca, Minn.
Electric Construction Co.

Johnson, Edgar W., 1914 C., 1915 C.E.
3821 Elliott Ave., Minneapolis.
Instr. in Mathematics, University of Minnesota.

Johnson, Ellsworth 1922 C.
Sheridan, Wyo.
Instrumentman, Wyoming North & South R. R.

Johnson, Elmer Walter 1914 E., 1915 E.E., 1923 M.E.
2880 James Ave. S., Minneapolis, Minn.
Instr. in Mathematics and Mechanics, University of Minnesota.

Johnson, Elving Latimer 1923 A.
1529 University Ave. S. E., Minneapolis, Minn.
Draftsman, Bertrand & Chamberlin, Archts.

***Johnson, Frank Edward** 1900 E.

Johnson, Gustav Adolph 1923 E.
806 6th St. S. E., Minneapolis, Minn.
Transmission Engr., N. W. Bell Telephone Co.

Johnson, Herman Richard 1909 E.
499 51st St., Milwaukee, Wis.
Sales Engr., Westinghouse Electric & Mfg. Co.

Johnson, Ira Leroy 1916 M., 1917 M.E.
313 South Arch St., Aberdeen, S. D.
Machinist, Gilbert Mfg. Co.

Johnson, James Percy 1923 E.
1525 East River Road, Minneapolis, Minn.
Division Commercial Accountant, N. W. Bell Telephone Co.

Johnson, John E. 1911 E.
Address unknown; information requested.

Johnson, Leonard T. 1910 E.
14507 Sciota Ave., E. Cleveland, O.
Engr., W. J. Rainey, Inc.

Johnson, Nels 1905 C.
Hayden, Arizona.
Chief Engr., Ray Consolidated Copper Co.

Johnson, Nels 1923 C.
1110 5th St. S. E., Minneapolis.
Draftsman, M. St. P. & S. Ste. M. R. R. Co.

Johnson, Noah 1894 C.
6270 Cates Ave., St. Louis, Mo.
Valuation Engr., Wabash R. R.

Johnston, Charles Kinsell 1921 E.
1206 5th St. S. E., Minneapolis.
Kinsell Auto Sales.

Johnston, Ralph Estes 1916 C., 1917 C.E.
1640 Fargo Ave., Chicago, Ill.
Head Estimator, Paul J. Kalman Co.

Johnston, William Wood 1900 M.
Address unknown; information requested.

***Jones, C. Paul** 1896 C.

Jones, Edwin Francis 1917 M.
701 E. Jessamine St., St. Paul
Mech. Engr., Chas. L. Pillsbury Co.

Jones, George R. 1914 E., 1915 E.E.
510 East 14th St., Minneapolis, Minn.
Industrial Electric Co.

Jones, Ivor Vaughan 1915 C.
38 South Dearborn St., Chicago, Ill.
Supervising Engr., Lockwood Greene & Co.

Jones, Lewis Allen 1907 C.
49 Chestnut St., Takoma Park, Washington, D. C.
Sen. Drainage Engr., U. S. Dept. of Agriculture.

Jones, Raymond Leslie 1905 E.
5356 Manila Ave., Oakland, Calif.
Engr., Pac. Tel. & Tel. Co., San Francisco.

Jones, Robert A. 1915 E., 1916 E.E.
P. O. Box 663, Schenectady, N. Y.
Engr., General Electric Co.

Jones, Watkin W. 1911 E.
Price, Utah.
Consult. Engr.

Jordan, Frank William 1919 E.
17 Smelter Hill, Great Falls, Mont.
Sales Engr., Westinghouse Elec. & Mfg. Co., Butte.

Jorgens, C. R. D., 1912 C., 1913 C.E.
Address unknown; information requested.

Josephson, Eliot Bryant 1910 E.
927 East Ave., Red Wing, Minn.
Retail Clothier.

Judd, Maurice D. 1923 C.
1925 Colfax Ave. S., Minneapolis, Minn.
Estimator, St. Paul Foundry Co.

Jules, Harold Arnesen 1920 E.
2011 Farmers Bank Bldg., Pittsburgh, Pa.
Sales Engr., Cutler-Hammer Mfg. Co.

Juvrud, Edwin C. 1917 E.
Rothsay, Minn.
Willys Farm Lighting Plants.

Kannenberg, Walter Frederick 1923 E.
230 Thomas, St. Paul, Minn.
Engr., Northwestern Bell Tel Co., Minneapolis, Minn.

Kaplan, Eugene V. 1910 M.
7929 Riverview Ave., Swissvale, Pa.
Engr., Westinghouse Elec. & Mfg. Co., East Pittsburgh.

Kaplan, Seeman 1918 A.
4553 Harriet Ave. S., Minneapolis, Minn.
Liebenberg and Kaplan, Archts.

Kapphahn, Ernest Harvey 1919 G.
116 S. Spring Ave., Sioux Falls, S. D.
Highway Supt., Minnehaha County.

Kapphahn, Roy J. 1912 C., 1913 C.E.
1732 E. 4th St., Duluth, Minn.
Gen. Contr., R. J. Kapphahn Contract. Co.

Kasper, Walter F. 1911 M.
426 E. 1st St., Fairmont, Minn.
Chief Engr., Fairmont Railway Motors, Inc.

Katter, Calvin K. 1922 M.
816 Summit Ave., St. Paul, Minn.
Radio Expert, Dispatch Printing Co.

Katter, Reuben L. 1922 M.
816 Summit Ave., St. Paul, Minn.
Asst. Cr. Mgr., E. E. Atkinson & Co., Minneapolis, Minn.

Kauffman, Roy 1908 E.
Care Improvement Co., Bisbee, Ariz.

Kearney, Adrian A. 1923 E.
1398 Albany St., St. Paul, Minn.
Sales Dept., Northern States Power Co., Minneapolis.

Keeler, Jasper Francis 1922 C.
3932 Aldrich Ave. S., Minneapolis.
Bridge Dept., G. N. Ry.

Keiser, Karl Wesley 1923 M.
1148 Churchill Ave., St. Paul, Minn.
Graduate student, University of Minnesota.

Kelly, Earl Wallace 1907 C.
707 E. 2nd St., Duluth, Minn.
E. W. Kelly Co., Engrs.

Kelley, William 1922 C.
Long Lake, Minn.
Kelly & Kelly, Landscape Engrs.

Kelsey, Howard Christian 1922 M.
5042 W. 24th St., Cicero, Ill.
Student Engr., Western Electric Co., Chicago.

Kerns, Clinton B. 1915 M.
Copperhill, Tenn.
Chief Draftsman, Tenn. Copper Co.

Kerns, Ralph W. 1907 E.
Clarksdale, Ariz.

King, Alfred Benjamin 1908 E.
125 E. 46th St., New York City.
Eastern Sales Mgr., Elec. Machinery Mfg. Co.

King, F. V. 1912 C., 1913 C.E.
Los Angeles, Cal.
Care South California Edison Co.

King, Harvey M. 1918 A.
161 Huntington Ave., Suite 3, Boston, Mass.
Draftsman, Frank Irving Cooper, Inc.

King, John Edward 1922 E.
5341 W. 22nd St., Cicero, Ill.
Equipment Engr., Western Elec. Co., Chicago.

King, Lawrence Watson 1909 C.
1829 Lincoln Ave., St. Paul, Minn.
Chief Clerk, St. Paul Fire & Marine Ins. Co.

***King, Robert N.** 1908 G.

Kingsley, Norman Willard 1920 E.
814 Essex St. S. E., Minneapolis.
Div. Interference Engr., N. W. Bell Telephone Co.

King, Wesley Eugene 1905 C.
1544 Goodrich Ave., St. Paul, Minn.
Engr., Toltz, King & Day Co., Inc.

Kinsell, William Leonard 1900 E.
409 E. 18th St., Minneapolis, Minn.
Garage Owner.

Kircher, Frank J. 1909 M.
Montevideo, Minn.

Kircher, George A. 1909 M.
Hudson, Wis.

Kivley, Ray Charles 1918 M.
156 No. Oak Park Ave., Oak Park, Ill.
Engr., Western Elec. Co., Chicago.

Kivley, Warren Olavus 1916 C.
Y. M. C. A., Helena, Mont.
Asst. Office Engr., State Highway Commission.

Kjosness, Ingraham G. 1903 M.
425 5th St., Lewiston, Idaho.
Vice Pres. and Treas., Madison Lumber & Mill Co.

Klass, Frederick 1919 E.
30 Bedford Road, Schenectady, N. Y.
General Elec. Co.

Kleinschmidt, Armin R. 1922 M.
416 West Given St., Mankato.
Gen. Construction, C. R. Meyer & Sons Co., Winters, Wis.

Kleinschmidt, Florian A. 1920 A.
416 Given St., Mankato, Minn.
Architect.

Klemer, Frank Henry 1901 C.
316 2nd St. N. W., Faribault, Minn.
Pres., Faribault Woolen Mills Co.

Knapp, Lester H. 1912 E.
928 Orleans Ave., Keokuk, Ia.
Asst. Gen. Supt., Miss. River Power Co.

Knauss, Archibald Christian 1916 C., 1917 C.E.
817 Oakridge Ave., Madison, Wis.
[illegible]

Knight, Ralph J. 1915 C.
247 Cathedral Place, St. Paul, Minn.
Civil Eng., Druar and Milinowski, Min. Engrs.

Knopp, William R. 1909 M.
240 Audubon Park, Dayton, Ohio.
Representative of Delco.

Knowles, Everett Howland 1920 E.
Chuquicamata, Chile, S. A.
Jr. Elec. Engr., Chile Exploration Co.

Knowlton, Herbert Hamilton, 1908 C.
Fowler, Colo.

***Knowlton, Warren C.** 1902 C.

Knutson, Harry 1917 M.
4207 Cooke St., Duluth, Minn.
Chief Draftsman, Clyde Iron Works.

Koch, Karl L. 1923 E.
6550 St. Peter St., St. Paul, Minn.

Kochendorfer, Milton J. 1905 E.
384 Concord St., St. Paul, Minn.

Koepke, Walter Edwin
1913 C., 1914 C.E.
259 Hamilton Ave., New Brighton, Station Island, N. Y.
Sales Engr., Kalman Steel Co., New York City.

Konstantinopoulos, Nicholas 1918 C.
1473 Carmen Ave., Chicago, Ill.

Kopper, Edward, Jr.
1914 M., 1916 M.E.
809 Goodrich Ave., St. Paul, Minn.
H. C. McNair Co., Ry. Supplies.

Korslund, Harry J. 1920 A.
610 S. 1st St., Eagle Grove, Ia.
Architect, 102 Trowbride St., Cambridge, Mass. Studying at Harvard.

Kotz, Walter E. 1923 C.
415 Marshall Ave., St. Paul, Minn.
Computer, G. N. Ry.

Krag, Walter G. 1907 M.
23 Columbia Court, Columbus, O.

Krauch, William Louis 1908 C.
1678 Lincoln Ave., St. Paul, Minn.
Structural Engr., George J. Grant Construction Co.

Kreinkamp, Herbert A. 1922 A.
1100 W. 8th St., Los Angeles, Cal.
Draftsman, O. K. Westphal, Archt.

Kreinkamp, Linton Herrmann, 1917 A.
1344 Florida St., Los Angeles, Cal.
Draftsman, Walker & Eisen, Los Angeles.

Kristy, George A. 1909 E.
508 S. Dearborn St., Chicago, Ill.
Mgr., Brilliant Search Light Mfg. Co.

Kriz, Joseph John
1912 C., 1913 C.E.
7250 Cornell Ave., Chicago, Ill.
Estimator and Designer, Robins Conveying Belt Co.

Kroeze, Herbert Andrew 1919 G.
755 North St., Jackson, Miss.
Chief Engr., Miss. State Board of Health.

Kruse, Heimer Victor
1913 C., 1914 C.E.
Clemenceau, Ariz.
Chief Civil-Mech. Engr., United Verde Ex. Mining Co., Jerome, Ariz.

Kruse, Orlin C. 1920 E.
Browntown, Minn.
Engr., Western Electric Co., Chicago, Ill.

Kuhlman, Rudolph H. 1923 M.
623 E. 32nd St., Minneapolis, Minn.
Valuation Engr., with Delos F. Wilcox.

Kumm, Arthur W. 1922 M.
Houston, Texas.
Instr. of Mech. Eng., Rice Institute.

Kvitrud, Ingwald 1911 C.
2001 7th St. S., Minneapolis, Minn.

Lagaard, Alexander Simon Theo.
1913 E., 1914 E.E.
4732 Park Ave., Minneapolis, Minn.
Patent Attorney, 709 Globe Bldg.

Lagaard, Maurice B.
1914 C., 1915 C.E.
4821 Columbus Ave. S., Minneapolis, Minn.
Asst. Prof. of Structural Eng., University of Minnesota.

Laird, Lee Rush 1903 E.
60 Second St. S., Orange, N. J.
Eng. Dept., Western Elec. Co., New York City.

Lambert, Edwin M. 1909 M.
977 14th Ave. S. E., Minneapolis, Minn.
Prof. of Mining Eng., University of Minn.

Lambert, Fred Theodore 1902 C.
Land Valuation Dept., N. P. Ry., St. Paul, Minn.

Lambie, Horace H. 1923 E.
104 Forest Ave., River Forest, Ill.
Suburban Plant Eng. Dept., Ill. Bell Tel. Co.

***Lamoreaux, L. A.** 1887 E.X.

Landeen, Arvid G. 1910 E.
Western Elec. Co., New York City.

Lang, Charles Arthur 1906 E.
2011 James Ave. S., Minneapolis.
Engr. of Constr., C. F. Hagelin & Sons Co.

Lang, Fred C. 1908 C.
Asst. Prof. of Highway Eng., Univ. of Minn., and Engr. of Tests & Inspection, Minn. Highway Dept.

Lang, James Sherburne
1896 M., 1897 E.E., 1899 M.E.
508 Belmont St., Watertown, Mass.
Pres., J. S. Lang Engineering Co., Boston, Mass.

Langland, Harold Severin 1919 E.
Grand Rapids, Mich.
Engr. with Dr. Delos F. Wilcox, Valuation.

Larson, Albin 1914 C.
1206 5th St. S. E., Minneapolis, Minn.
Asst. Prof. of Agr. Botany, University Farm, St. Paul.

Larson, Amandus C. 1920 C.
721 Superior St. S. E., Minneapolis.
Engr., Morell & Nichols, Landscape Archts.

Larson, Carl 1916 C.
3955 Emerson Ave. N., Minneapolis, Minn.
Structural Draftsman, Soo Line Ry.

Larson, Edwin 1921 A.
232½ So. Snelling Ave., Apt. 4, St. Paul, Minn.

Larson, Glen M. 1923 M.
Willmar, Minn.
Eng. Dept., Stockland Road Mach. Co., Minneapolis.

Larson, Ludvig Conrad 1921 E.
3427 1st Ave. S., Minneapolis, Minn.

Larson, Louis I., 1914 C., 1915 C.E.
808 West Indiana Ave., Urbana, Ill.

Larson, Martin S. 1911 M.
5204 27th Ave. S., Minneapolis.
Eng. Dept., Flaxlinum Insulating Co., St. Paul.

Larson, Victor F. 1917 M.
127 N. 54th Ave. W., Duluth, Minn.
Mech. Draftsman, National Iron Co.

Larson, Walter J. 1920 E.
1827 Chapman Ave. East, Cleveland, Ohio.
Quality Engr., Mazda Lamp Div., Gen. Elec. Co.

Laurence, Philip Johnson
3120 Humboldt Ave. S., Minneapolis, Minn.
Contractor, J. A. McDonald Constr. Co.

Lawrence, Scott 1915 E., 1916 E.E.
Montevideo, Minn.

Layden, Arthur Louis 1915 E.
1306 Vista St., Hollywood, Calif.
Salesman, Tropico Potteries, Inc., Glendale.

Lazarus, Morris William 1923 C.
522 Girard Ave. N., Minneapolis, Minn.
Struct. Draftsman, Minneapolis Steel & Machinery Co.

Leach, Edward William 1910 C.
Keewatin, Minn., care Bennett Mine.
Gen. Supt., Western Dist., Pickands, Mather & Co.

Lebeck, Carl E. 1920 C.
1319 Adams St. N. E., Minneapolis, Minn.
Junior Civil Engr.

Le Blond, Edmond J. 1905 E.
105 Cambridge Ave., St. Paul.
Supt., Elec. Dept., Northern States Power Co.

Lee, Engbret A. 1897 C.
1746 Franklin St., Denver, Colo.
Chief Engr., Am. Smelting & Refining Co.

Lee, Oscar Clarence 1919 E.
1499 Hythe St., St. Paul, Minn.
Instructor in Math. & Mech., University of Minn.

Lee, Walter J. 1920 E.
14926 Terrace Road, East Cleveland, Ohio.

Lende, Henry M. 1920 C.
51 S. 13th St., Minneapolis.
Engr., Minneapolis Park Board.

Leonard, Aubrey C. 1923 C.
Y. M. C. A., Rochester, Minn.
Olmsted County Highway Dept.

Leonard, Henry Clay
1875 C., 1878 B.S.
Route 1, Box 65, Santa Anna, Calif.

Leonard, Thomas Kenneth
1915 C., 1916 C.E.
3803 Harriet Ave. S., Minneapolis.
Supt., Toltz, King & Day, Engrs. and Archts., St. Paul.

Le Tourneau, Edward Harold, 1905 E.
719 W. 180th St., New York, N. Y.
Chief, Repair Section, Standard Oil Co.

Levens, Alexander S. 1922 C.
540 Irving Ave. S., Minneapolis.
Instructor in Drawing and Descriptive Geometry, University of Minn.

Levin, Jake Mose 1918 E.
3043 2nd Ave. S., Minneapolis, Minn.
Asst. Foreman, Levin Bros., Inc., Mfrs.

Lewis, Carroll Eugene 1919 G.
Lang, Rangland and Lewis, Archts.

Lewis, Edward B. 1905 M.
2263 Commonwealth Ave., St. Paul.
Engr., National Heating & Ventilating Co., Minneapolis.

Lewis, George Reese 1921 M.
2871 Irving Ave. S., Minneapolis.
Salesman, W. S. Nott Co.

Liddle, Ralph Wesley 1921 G.
Carthage, S. D.
Commonwealth Edison Co., Chicago, Ill.

Liebenberg, Jacob Josephus, 1916 A.
1017 James Ave. N., Minneapolis.
Liebenberg & Kaplan, Archts.

Lieberman, Henry 1923 E.
407 W. Central Ave., St. Paul, Minn.
Tri-State Tel. & Tel. Co.

Lilly, Clarence W. 1917 E.
612 W. 35th St., Minneapolis, Minn.
Engr. of Design, Minn. Highway Dept.

Lilly, Eugene 1919 G.
223 Grotto St., St. Paul, Minn.

Lin, Shu Ming 1920 A.
Peking, China.

Lindelet, Charles G. 1909 E.
867 West 5th St., Riverside, Cal.
Chief Engr., Yellowstone Park Hotel Co., Yellowstone Park, Wyo.

Lindelien, Eugene 1923 M.
3210 Arthington St., Chicago, Ill.
Equip. Engr., Western Elec. Co.

Linden, Henning 1917 C.
2713 12th Ave. S., Minneapolis.
Captain, U. S. Army, U. of Maryland, College Park, Md.

Linhoff, Carl Henry 1922 E.
242 Union St., Schenectady, N. Y.
Gen. Elec. Co.

Little, Alise V. 1922 A.
631 Oak St. S. E., Minneapolis.

Lockwood, Raymond Albert 1920 E.
3024 University Ave. S. E., Minneapolis, Minn.
Bus. Affairs Sec., St. Paul Assn. of Business & Public Affairs.

Loe, Eric Haldorson 1888 M.
Odin Club, Minneapolis, Minn.
Russell-Miller Co.

Loeffler, Henry Stanley
1914 E., 1915 E.E.
1723 La Fond St., St. Paul, Minn.
Asst. Engr., Bridge Dept., Great Northern Ry.

Long, Fred Winston 1896 C.
217 E. 1st St., Jacksonville, Fla.
Asst. Engr., G. & F. Railway Co.

Longfellow, Dwight Webster, 1908 C.
Elk River, Minn.
Secy. & Treas., Elk River Concrete Products Co.

Lonie, James Henry 1897 M.
2112 Summit St., Columbus, O.
Engr., The Kilbourne & Jacobs Mfg. Co.

Lovering, Harry Douglas
1913 C., 1914 C.E.
1854 Laurel Ave., St. Paul, Minn.
Contr. Engr., Lovering-Longbotham Co.

***Loy, George John** 1884 C.

Loye, Benj. Whipple 1906 M.
14433 Westlawn Blvd., N. W. Station, Detroit, Mich.
Asst. Supt., Detroit Insulated Wire Co.

Loye, Donald 1916 E., 1917 E.E.
1769 East 24th St., Brooklyn, N. Y.
Engr., American Tel. & Tel. Co., New York, N. Y.

Loye, Edwin M. 1920 A.
226 Henry St., Brooklyn, N. Y.
Traveling in Europe.

Loye, Percival Elliot
1921 E., 1922 E.E.
407 Cowper St., Palo Alto, Cal.
Const. Engr., Pacific Gas & Elec. Co., San Francisco, Cal.

Luce, Alexander Walker 1921 M.
525 16th Ave. S. E., Minneapolis.
Minneapolis Tribune.

Luedeman, Clarence H. 1923 A.
6103 Kenbark Ave., Chicago, Ill.
Struct. Engr., H. L. Stevens & Co.

Lund, Earl Hildrith 1922 C.
730 Jefferson St. N. E., Minneapolis.
Inspector, U. S. Government, Milwaukee, Wis.

Lundquist, John V. 1923 E.
North Hibbing, Minn.

Lundquist, Reuben Alvin 1905 E.
Room 817, Commerce Bldg., Washington, D. C.
Chief, Elec. Div., U. S. Dept. of Commerce.

Luplow, Walter D. 1917 C.
Salem, N. J.

Lutz, Richard Eugene 1915 E.
335 Hampshire Arms, Minneapolis.
Civil Engr., R. D. Thomas, Cons. Engr.

Lux, Arthur Ernest 1916 C.
224 Aurora Ave., St. Paul, Minn.

Luxford, Ronald F. 1917 C.
1606 Hoyt St., Madison, Wis.
Engr., U. S. Forest Products Co.

Lyford, Dartt Hendrickson 1911 E.
23 Bonita Ave., Long Beach, Cal.
Engr., Research & Development Div., Union Oil Co., Los Angeles, Cal.

Lyon, Glenn H. 1920 A.
816 Wealthy St. S. E., Grand Rapids, Mich.
Draftsman, H. H. Turner, Archt.

Macgowan, Irving 1923 C.
Draftsman, Santa Fe Terminal Bldg., Dallas, Texas.

Mackintoash, William Strathern
1921 C.
590 Ashland Ave., St. Paul, Minn.
Inspector, Minn. Highway Dept.

MacKusick, Elwood M. 1899 E.
904 Forum Bldg., Sacramento, Cal.

McAfee, Allan Lindsay 1908 E.
Harrisburg, Ore.
General Merchandise.

McCall, Harry John 1908 C.
114 N. Snelling Ave., St. Paul, Minn.
Roadmaster, N. P. Ry.

McCartney, Floyd Allen 1913 M.
Address unknown; information requested.

McClelland, Claude Leslie 1902 C.
Address unknown; information requested.

McCoy, Ira Clark 1911 E.
317 N. Eastern Ave., Joliet, Ill.
Instructor, Joliet Township High School.

McCree, Andrew A. 1908 C.
1733 Ashland Ave., St. Paul, Minn.
Vice Pres., McCree, Moos & Co., Engrs. and Contrs.

McCubrey, Everett James 1921 C.
Cologne, Minn.
Resident Engr., Minn. State Highway Dept.

McCullough, Bruce Murdock, 1916 C.
Litchfield, Minn.
Presbyterian Minister.

McCullough, Robert T. 1923 E.
119 4th Ave., Bay Shore, N. Y.
Field Engr., Long Island Lighting Co.

McEachin, John L. 1922 E.
Hibbing Hotel, Hibbing, Minn.
Engr., Micka Asplund Co., Electrical Contractors.

McKay, Earle D., 1915 C., 1916 C.E.
710 E. 34th St., Minneapolis, Minn.
Engr., Service Bureau, Universal Portland Cement Co.

McKechan, Louis Williams 1908 G.
3 Highland Place, Maplewood, N. J.
Research Engr., Western Elec. Co., New York, N. Y.

McKellip, Frank Woodman 1898 E.
503 4th Ave. S. W., Faribault, Minn.
City Engr.

McKenzie, Lauren F. 1909 E.
1019 E. Thomas St., Seattle, Wash.
Dist. Sales Mgr., Linde Air Products Co.

McKenzie, Leonard F. 1920 E.
1542 W. 16th St., Los Angeles, Cal.
Draftsman, So. Cal. Edison Co.

McKibben, Lloyd S. 1921 E.
1710 Stevens Ave., Minneapolis.
Estimator and Job Supt., Langford Elec. Co.

***McKibben, Ray** 1917 E.

McKittrick, James 1901 C.
Address unknown; information requested.

McLean, Milton Duncan 1921 G.
2330 N. Halsted St., Chicago, Ill.
Student, McCormick Theological Seminary.

McMeekin, Glenn Dwight 1921 G.
Box 343, Highland Park, Ill.
Engr., Public Service Co., Chicago.

McMillen, James Stewart 1922 E.
Ottumwa, Ia.
Sales Dept., Ottumwa Ry. & Light Co.

McMillian, Franklin R. 1905 C.
140 West Elmwood Place, Minneapolis, Minn.
Structural Engr. with Adolph F. Meyer, Cons. Hyd. Engr.

McPherson, William Butler 1902 E.
1516 Raymond Ave., St. Paul, Minn.
Engr., Minn. By-Product Coke Co.

McQuillin, Raymond Eugene, 1911 E.
Fort Riley, Kans.
Instr., Signal Communications, U. S. Cavalry School.

McVean, Norman Stuart 1921 E.
200 S. 13th St., Minneapolis, Minn.
Asst. Editor, H. C. Cooper Pub. Co.

Madden, Francis 1903 C.
Address unknown; information requested.

Madsen, Olav 1920 G.
Address unknown; information requested.

Magnusson, Carl Edward 1896 E.
4521 19th Ave. N. E., Seattle, Wash.
Dean, College of Eng., University of Washington.

Magnuson, John E. 1922 E.
720 W. 3rd St., Duluth, Minn.
Engr., Phoenix Utility Co.

Mahoney, William Louis
1913 E., 1914 E.E.
508 4th St. N. E., Minneapolis, Minn.
Gen. Supt., Consumers Power Co., Grand Rapids, Mich.

Maine, Basil Claire 1921 E.
38 Glenwood Blvd., Schenectady, N. Y.
General Electric Co.

Maiser, Walter L. 1923 C.
886 18th Ave. S. E., Minneapolis, Minn.
Computer, Legal Valuation Div., G. N. R. R., St. Paul.

Malley, Charles James 1906 C.
Address unknown; information requested.

Malmberg, Victor A. 1920 C.
Winthrop, Minn.

Malmstrom, Axel L. 1917 E.
1127 Philadelphia Ave., Detroit, Mich.
Distribution Engr., Detroit Edison Co.

Manderfeld, Emanuel Carl 1921 E.
Engr., Engineering Dept., Western Electric Co.
463 West St., New York, N. Y.

Maney, George Alfred 1911 C.
3628 18th Ave. S., Minneapolis, Minn.
Asst. Prof. of Structural Eng., University of Minn.

Manger, Henry J. 1923 C.
Danbury, Wisconsin.
Draftsman, Northern States Power Co.

Mangney, Elmer John 1921 E.
South Shore, S. D.
Instr., South Shore High School.

Mann, Fred Maynard
1893 C., 1898 C.E.
202 Ridgewood Ave., Minneapolis.
Professor of Architecture, University of Minn.

Mark, Reuben Andrew 1911 C.
1024 Williams St., Brookings, S. D.
A. M. Wold-Mark Constr. Co.

Mark, Walter J. 1909 M.
Brookings, S. D.
Constr. Engr. and Supt., A. M. Wold-Mark Constr. Co.

Markhus, Olaf G. F. 1897 E.
919 N. 17th St., Boise, Idaho.
Gen. Mgr., Idaho Railway Light & Power Co.

Markoe, James 1912 M.
3109 Ruckle St., Indianapolis, Ind.
Draftsman and Designer with Mr. Fred Duesenberg, racing cars.

Markson, Christian Orrin 1922 C.
Foley, Minn.
Instrumentman, Minn. State Highway Dept.

Markuson, Miner John 1923 A.
Virginia Polytechnic Institute, Blacksburg, Va.
Instructor, Extension Specialist.

Markuson, Oscar S. 1911 E.
2616 S. 60th Court, Cicero, Ill.
Engr., Western Elec. Co., Chicago, Ill.

Marshall, Chester R. 1923 M.
317 5th Ave. S. E., Minneapolis, Minn.
Asst. Field Engr., Northern States Power Co.

Marshall, Donald Eddy 1919 E.
615 Jewett Ave., West New Brighton, Staten Island, N. Y.
Supt. of Mfg., Proctor & Gamble Co., Cincinnati, O.

Martin, Curtis Richard 1921 G.
Waconia, Minn.
Supt. of Public Schools.

Martin, Wallace H. 1910 M.
Corvallis, Ore.
Prof. of Mech. Eng., Oregon Agr. College.

***Mason, Arthur Pearson** 1916 M.

Mathes, Robert C.
1912 E., 1913 E.E.
1380 Merriam Ave., New York City.
Engr., Western Electric Co.

Matteson, Frank Elmer 1906 M.
Address unknown; information requested.

***Matthews, Irving Webber** 1884 C.

Mattison, George Carl 1911 C.
1342 Jefferson St. N. W., Washington, D. C.
Hydrographic and Geodetic Engr.

Mattison, Oliver 1905 C.
4825 Pleasant Ave., Minneapolis, Minn.
Pres., Minneapolis Bridge Co.

Mattson, Dewey F. 1922 C.
4004 17th Ave. S., Minneapolis, Minn.
Civil Engr., Morell & Nichols, Landscape Archts.

Maver, Albert Ferdinand 1920 E.
191 Hamline Ave. N., St. Paul, Minn.
T. E. Olen Co.

Mayer, Harris J.
1914 M., 1915 M.E.
4237 Sheridan Ave. S., Minneapolis, Minn.
Asst. Supt. Const., F. W. Woolworth Co.

Meany, James M. 1907 M.
686 E. 15th St. N., Portland, Ore.
In Charge of Sales, Lidgerwood Mfg. Co., Seattle and New York.

Meili, Rudolph Ernest, Jr. 1922 G.
2215 Bryant Ave. S., Minneapolis
Mech. Dept., Mpls. & St. Louis R. R. Co.

Meixner, Bernard A. 1910 M.
1459 Palace St., St. Paul, Minn.
Sales Engr., R. B. Mitacre & Co.

Melander, Albin Reinhold 1921 A.
Fargo, N. D.
Instructor in Design, N. D. Agri. College, N. D.

Melby, Einar C. 1917 E.
New York, N. Y.
Mgr., Eng. Dept., N. Y. Oversea Co.

Mentzer, Clarence Allen 1922 E.
4735 Colfax Ave. N., Minneapolis, Minn.
Eng. Dept., Stockland Road Mach. Co.

Merriell, Elmer William
1912 E., 1913 E.E.
5020 2nd Ave. S., Minneapolis, Minn.
Asst. Mgr., Minn. Mazda Lamp Division of G. E. Co.

Merrill, Lewis E. 1920 M.
3124 S. 5th St., Minneapolis, Minn.
Second Asst. Credit Mgr., Mpls. Steel & Machinery Co.

Merritt, Alva Weston 1922 E.
Robbinsdale, Minn.
Farmer.

Mertz, Karl J. 1914 E.
1753 Marshall Ave., St. Paul, Minn.
Elec. Engr., St. Paul Gas Light Co.

Meserve, Ralph H. 1923 E.
2717 S. E. Delaware, Minneapolis.
Engr., St. Paul Gas & Light Co., St. Paul.

Meskal, George 1923 C.
Montgomery, Minn.
Instrumentman, Minn. State Highway Dept., Frontenac, Minn.

Messer, Harold D. 1923 M.
1165 So. Oak Park Ave., Oak Park, Ill.
Engr., Commonwealth Edison Co., Chicago, Ill.

Methven, Clyde 1911 C.
92 Orlin Ave. S. E., Minneapolis, Minn.
Div. Engr., State Highway Dept., St. Paul, Minn.

Meyer, Carl F. 1910 C.
1601 Hillside Ave. N., Minneapolis, Minn.
Road Engr., Court House.

Meyer, Herbert W. 1914 E.
4905 Garfield Ave. S., Minneapolis, Minn.
Statistical Engr., Northern States Power Co.

Mikesh, Edward S. 1922 M.
439 Arbor St., St. Paul, Minn.
Heating and Sales Engr., Crane Co.

Mikesh, Martin A.
1912 M., 1913 M.E.
223 Oneida St., Milwaukee, Wis.
Mech. Engr., A. O. Smith Corp.

Miller, Andrew Lincoln 1921 E.
Ann Arbor, Mich.
Instructor in Elec. Eng., University of Mich.

Miller, Ervin John 1911 C.
101 Arthur Ave. S. E., Minneapolis.
Asst. Bridge Engr., Minn. Highway Dept., St. Paul.

Miller, George 1920 E.
2158 Carroll St., St. Paul, Minn.
Super. Engr., Commonwealth Electric Co.

Miller, Hollis De Witt 1913 E.
P. O. Box 15, Westwood, Cal.
Instructor in Mech. Arts, Public Schools.

***Miller, Lucius W.** 1903 E.

Miller, William Charles 1916 M.
Address unknown; information requested.

Miller, William Lott 1897 E.
Winona, Minn.
Vice Pres. and Gen. Mgr., Union Fibre Co.

Mintz, Nathaniel 1922 E.
1419 Cedar St., Milwaukee, Wis.
Production Engr., Cutler-Hammer Mfg. Co.

Mitchell, Alexander Cuthbertson
1920 E.
949 Chicago Ave., Oak Park, Ill.
Engr., Am. Tel. & Tel. Co., Chicago.

Mitchell, John B. 1909 C.
1658 Jefferson Ave., St. Paul, Minn.
1233 G. N. Bldg., Asst. Engr., Valuation Dept., G. N. R. R.

Mitchell, L. Morris
1914 C., 1915 C.E.
305 No. 12th Ave. East, Duluth, Minn.
Engr. and Estimator, Naufts & Bergstrom, Gen. Contractors.

Mitchell, Lloyd S. 1923 C.
510 Davidson Bldg., Sioux City, Ia.
Engr., Ward & Weighton, Contrs.

Mittag, Albert H. 1911 E.
115 Elmer Ave., Schenectady, N. Y.
Eng. Dept., Gen. Elec. Co.

Mixer, Walter R. 1917 A.
1149 Raymond Ave., St. Paul.
Asst. Bldg. Supt., University Farm, St. Paul.

Moffat, George Nichol
1919 M., 1920 M.E.
R. F. D. No. 4, Lockport, N. Y.

Molskness, Nels S. 1920 E.
3300 Beach Ave., Chicago, Ill.
Tel. Eng., Western Electric Co.

Montgomery, Albertus 1913 C.
4430 Thomas Ave. S., Minneapolis.
Field Engr., Portland Cement Assn., Oklahoma City, Okla.

Moody, Chester Sherman
1916 M., 1917 M.E.
2709 Blaisdell Ave., Minneapolis.
Metallurgical Engr., Minneapolis Steel & Machinery Co.

Moore, Clarence F. 1920 G.
Riverside, Ill.
Bridge Dept., C. B. & Q. R. R., Chicago, Ill.

Moorman, Albert Juon 1918 A.
1615 Stanford Ave., St. Paul, Minn.
Moorman & Co., Bank Bldrs.

Moorman, Frank S. 1922 A.
728 Goodrich Ave., St. Paul, Minn.
Asst. to Mgr., A. Moorman, Bank Bldrs.

Moreno, Gerardo 1923 E.
P. O. 234, Manila, P. I.

Mori, Nathaniel R. 1917 E.
Address unknown; information requested.

Morris, John E. 1909 M.
3442 11th Ave. S., Minneapolis.
Secy. and Treas., Stacy-Bates Co., Mftrs. Agents.

Morris, John O.
1888 M., 1903 M.E.
4445 Berkeley Ave., Chicago, Ill.
Cons. Engr.

Morris, Robert 1905 E.
Address unknown; information requested.

Morris, Thomas Carlyle 1908 M.
Detroit, Mich.
Engr., Lockwood, Greene & Co.

Morrison, John E. 1922 C.
516 4th St. S. E., Minneapolis, Minn.
Field Engr. on Construction, Northern States Power Co.

Morse, Frank 1893 A.
Address unknown; information requested.

Morse, George Humphrey 1922 M.
Minneapolis, Minn.
Underwriters at Lloyds.

Morse, George Alfred
1913 C., 1914 C.E.
Care Mrs. F. L. Doubleday, 909 Platt St., Tampa, Fla.

Morse, George Hart
1893 E., 1911 E.E.
10 So. 16th St., Philadelphia, Pa.
Grant Power Survey.

Morton, Harry Garfield 1904 E.
4157 Lyndale Ave. S., Minneapolis, Minn.
Traffic Engr., Northwestern Bell Telephone Co.

Morton, Harold Sylvanius
1912 M., 1913 M.E.
108 Pierce St., St. Paul, Minn.
Engr. of Tests, North Western Fuel Co.

Motl, Charles Leopold 1910 C.
2375 Doswell Ave., St. Paul, Minn.
Div. Engr., Minnesota Highway Dept.

Mowery, Clarence Ward 1908 C.
1379 Hamline Ave. N., St. Paul.
Supt., Curtis Hotel, Minneapolis, Minn.

Mowry, Harry Wheelock 1906 E.
3326 Home Ave., Berwyn, Ill.
Chief of Machine Switching, Western Elec. Co., Chicago.

Moyer, Amos F. 1910 M.
100 Arthur Ave. S. E., Minneapolis, Minn.
Cons. Engr., Toro Mfg. Co.

Moyer, Malcolm B. 1909 M.
428 Filmore St., Davenport, Ia.
Mgr., Tri Cities Division.

***Mueller, Henry John** 1905 C.

Muessel, Robert Walter 1921 C.
1345 Portage Ave., South Bend, Ind.
Asst. Supt., South Bend Toy Mfg. Co.

Muller, Carl Christ 1918 M.
675 So. Wabasha St., St. Paul, Minn.
Checker, Standard Conveyor Co.

Murphy, John 1906 C.
Address unknown; information requested.

Murray, John Hays 1917 M.
1422 Broad St. S., Flint, Mich.
Irving C. Root Co., Flint, Mich.

Murrish, Frederic E. 1909 E.
220 South Carondelet St., Los Angeles, Cal.
Asst. to Vice Pres., Pan American Petroleum and Transport Co.

Myers, Mortimer 1897 E.
112 W. 103rd St., New York City.
Maintenance Co.

Nash, Russell O. 1923 E.
2024 30th Ave. S., Minneapolis, Minn.
Deerlodge, Mont., C. M. & St. P. R. R.

Nason, Geo. Lister 1910 C.
2210 Doswell Ave., St. Paul, Minn.
Landscape Architect.

Nebel, Walter Harry 1911 E.
70 Westland Ave., Boston, Mass.

Nekola, John W. 1907 M.
Denver, Colo.

Nelson, Carl Hugo 1910 E.
218 W. 2nd St., Aberdeen, Wash.
Supt., Grays Harbor Ry. & Light Co.

Nelson, Clarence Leonard 1920 E.
451 Dewey Ave., St. Paul, Minn.
Engr., St. Paul Gas Light Co.

Nelson, Donald Orelup 1920 C.
Hope Gardens, Troutdale, Ore.
Jun. Engr., Truscon Steel Co., Portland, Ore.

Nelson, E. A. 1923 C.
820 21st Ave. S., Minneapolis, Minn.
Asst. Engr., C. A. P. Turner Co., Cons. Engrs.

Nelson, Edward S. 1909 C.
1664 St. Clair St., St. Paul, Minn.
Arch. Mgr., C. H. Johnston, Archt.

Nelson, George A.
1912 E., 1913 E.E.
507 Roosevelt St., Enderlin, N. D.
Dentist.

Nelson, Glen 1923 C.
615 East Ocean, Long Beach, Cal.
Subdivision work, E. E. Mix, Engr.

Nelson, Gustaf Adolph 1919 E.
317 5th Ave. S. E., Minneapolis.
Clerk, Northern States Power Co.

Nelson, Nels Benoni 1904 C.
3441 Fremont Ave. S., Minneapolis.
Asst. Sales Mgr., Minneapolis Steel & Machinery Co.

Nelson, Oscar Benjamin 1905 C.
3229 30th Ave. S., Minneapolis.
Designing Engr., Chas. L. Pillsbury Co.

Nelson, Otis Stanley 1917 M.

Nelson, Richard L. 1921 E.
Address unknown; information requested.

Nelson, Thorwald E. 1890 M.
3447 11th Ave. S., Minneapolis.
Real Estate, International Falls Realty Co.

Nemec, Frank L. 1909 M.
Hopkins, Minn.
Mech. Engr., Fegles Constr. Co.

Neville, Earle L. 1920 C.
2015 Sheridan Ave. N., Minneapolis.
Field Engr., Foley Bros., Gen. Contrs., Lake Johanna.

Newbery, Lester Wayne 1922 C.
Farmington, Minn.
Draftsman, Minnesota Highway Dept.

Newhall, William Barrett 1900 M.
3120 James Ave. S., Minneapolis.
Instructor in Science, Edison High School.

Newman, John M. 1923 E.
2903 13th Ave. S., Minneapolis.

Nichols, Browning, Jr. 1910 M.
960 Faxon Ave., Memphis, Tenn.
Engr., Canal Construction Co.

Nickerson, Neal Clinton 1918 C.
Carlton, Minn.
Carlton County Engineer, State Highway Dept.

Nielson, Eunice Virginia 1923 A.
3233 Snelling Ave. S., Minneapolis.
Draftsman, Lang, Raugland & Lewis, Archts.

Nielsen, Walter M. 1922 E.
214 Walnut St. S. E., Minneapolis.
Teaching Fellow, Physics Dept., University of Minn.

Nilson, Wilhelm 1902 E.
R. F. D. No. 1, Box 77, Twin Valley, Minn.
Farming.

Noble, John Frithiof 1921 G.
312 Harvard St. S. E., Minneapolis.
Noble Realty Co.

Noel, Clay W. 1920 E.
Apt. 12, Chalfern Apts., Mansfield, Ohio.
Engr., Ideal Elec. & Mfg. Co.

Norcross, Arthur Floyd 1907 E.
185 Fairview Ave., Jersey City, N. J.
Inspecting Engr., N. Y. Steam Co., New York City.

Nordenson, Arnold 1922 M.
4244 12th Ave. So., Minneapolis.
Draftsman, Roberts Hamilton Co., Plumbers.

Nordlien, Berger William 1922 E.
314 Biddle Ave., Wilkinsburg, Penn.
Tester, Westinghouse Elec. & Mfg. Co., East Pittsburgh.

Nordstrom, Carl Theodore 1914 C.
3725 Longfellow Ave., Minneapolis.
Highway Engr., U. S. Bureau of Public Roads.

Nordstrom, Ernest Aldon 1922 M.
3115 2nd Ave. S., Minneapolis, Minn.
Service Station Superv., Standard Oil Co.

Nordvall, Glenn W. 1923 E.
Two Harbors, Minn.
Toll Pole Inspector, N. W. Bell Tel. Co., Minneapolis.

Norelius, Emil Francis 1908 M.
10 Courtland Apt., Davenport, Ia.
Automotive Engr., Rock Island Arsenal.

Norelius, Lewis Magnus 1906 C.
6019 26th St. N. E., Seattle, Wash.
Vice Pres., Majestic Furnace & Mfg. Co.

Nortner, Sylvester Emery 1916 C.
401 Penn Ave. N., Minneapolis.
Captain, Corps of Engrs., U. S. Army, Washington, D. C.

Norton, Clyde Wood
1908 M., 1909 M.E.
857 Grand Ave., St. Paul, Minn.
Vice Pres., Bingham & Norton, Inc.

***Novig, Ole Steffenson** 1903 E.

O'Brien, John Erwin 1898 M.
703 Graydon Park, Norfolk, Va.
Mngr., Mech. Dept., Seaboard Air Line Ry.

O'Brien, Raymond J. 1911 E.
511 Harrison Ave., St. Paul, Minn.
Sales Engr., Westinghouse Elec. & Mfg. Co., New York City.

Odegard, Harold Thurston 1920 M.
332 26th St., Milwaukee, Wis.
Special Apprentice, C. M. & St. P. Ry.

Odquist, Carl 1923 C.
519 10th Ave. S. E., Minneapolis.

Okes, Day Ira 1908 C.
2201 Humboldt Ave. S., Minneapolis, Minn.
Hanlon & Okes, Contrs.

Okes, Sidney R. 1909 C.
2312 Lyndale Ave. S., Minneapolis.

Olaison, Clifford Eugene
1915 E., 1916 E.E.
4032 Columbus Ave., Minneapolis.
Mgr., Radio Dept., Western Motor Supply Co.

Olin, Henry A. 1923 E.
328 No. 60 Ave. W., Duluth, Minn.
Wireman, Minn. Steel Co.

Olmstead, Charles Floyd
1922 M., 1923 M.E.
1525 E. River Road, Minneapolis.
Asst. Engr., Mahr Mfg. Co.

Olsen, Arthur Oscar 1910 C.
1345 Capitol Ave., Des Moines, Ia.
Sales Mgr., Redfield Brick & Tile Works.

Olsen, Arnim Gilbert 1922 E.
923 Galt Ave., Chicago, Ill.
Commonwealth Edison Co.

Olsen, Melvin Samuel 1908 C.
2919 46th Ave. S., Minneapolis.
Engr., Board of Education.

Olson, Elmer J. E. 1923 C.
513 W. Hemlock St., Chisholm, Minn.
Mining Engr., Oliver Iron Mining Co.

Olson, Richard Hall 1919 E.
2541 N. E. Filmore, Minneapolis.
Sales Engr., Elec. Machy. Mfg. Co.

Olson, Roy Howard 1923 E.
1514 2nd Ave. S., Minneapolis, Minn.
Bradbury & Caswell, Patent Attorneys.

Olstad, Oscar Arthur 1911 M.
105 Peter Boro St., Boston, Mass.
Little Bldg.

Oltman, Charles Albert 1903 C.
3027 46th Ave. S., Minneapolis.
Asst. Engr., C. St. P. M. & O. Ry., St. Paul.

Oram, Robert C. 1911 M.
314 San Fernando Bldg., Los Angeles, Cal.

Orbeck, Martin J. 1911 C.
528 Elm St., Ann Arbor, Mich.
Asst. Prof. of Drawing, University of Mich.

Orr, George M. 1915 M.
Afton, Minn.

Oscarson, Gerhard Lionel 1922 E.
513 Washington Ave. S. E., Minneapolis, Minn.
Testing Dept., Electric Machy. Mfg. Co.

Ost, Roland E. 1922 C.
202 14th St., Cloquet, Minn.
Asst. Resident Engr., The Northwest Paper Co.

Ott, Leonard E. 1914 C., 1915 C.E.
Marble, Minn.
Arthur Mining Co.

Otto, Frederick Arthur 1904 E.
639 Holly Ave., St. Paul, Minn.
Sales Engr., Stewart P. Browne Mfg. Co., New York City.

Otto, Robert Walter 1904 M.
2147 Carroll Ave., St. Paul, Minn.
Treas., Andrews Heating Co., Minneapolis, Minn.

Oustad, Olaf L. 1915 C.
Care Elmer Dill, Box 167, R. R. 3, Burbank, Calif.

Overholt, Harley George 1910 C.
2856 Irving Ave. S., Minneapolis.
Prof. of Structural Eng., St. Thomas College.

Ovestrud, Melvin 1913 M., 1914 M.E.
1338 So. 3rd St., Stillwater, Minn.
Asst. to Pres., Twin City Forge & Foundry Co.

Owens, Leo Edward 1911 M.
45 East 55th St., New York City.
Asst. Mech. Supt., New York World.

Page, Mark Lyman 1903 E.
918 Santa Clara St., Vallejo Solano Co., Calif.
Radio Elect., U. S. Navy, Mare Island, Cal.

Paida, Charles Herman 1922 C.
Winnebago, Minn.
Asst. Engr., Hanlon & Okes.

Palmer, Howard B. 1922 C.
406 Federal Bldg., Milwaukee, Wis.
Inspector, U. S. Eng. Office.

Palmer, Roy Archibald 1921 E.
Nela Park, Cleveland, Ohio.
Editor, Technical Publications, National Lamp Works.

Pan, Wen Ping 1916 C.
Address unknown; information requested.

Pancratz, Alexander 1905 M.
Fairbanks, Morse & Co., St. Paul.

Pancratz, Frank Joseph 1908 E.
Perham, Minn.

Pangburn, Carroll G. 1922 E.
202 N. Hamlin Ave., Chicago, Ill.
Equipt. Engr., Western Elec. Co.

Papenthien, Roy Oliver 1921 G.
758 51st, Milwaukee, Wis.
Arch. Engr., H. C. Haeuser, Archt.

Pardee, Charles Albert 1912 E., 1913 E.E.
425 Cary Ave., Ravinia, Ill.
Vice Pres. and Treas., Miller & Pardee, Inc., Chicago, Ill.

Pardee, Walter Stone 1877 A.
425 Cary Ave., Ravinia, Ill.
Miller & Pardee, Inc., Chicago, Ill.

Parkhurst, Harleigh 1900 E.
Address unknown; information requested.

Parkin, Orrin G. 1923 M.
Coleraine, Minn.
Oliver Mining Co.

Paul, Frederick Thornton 1909 C.
2710 Clinton Ave., Minneapolis.
Asst. Engr., City Engr's Office.

Paulsen, Thorwald S. 1922 C.
1595 Blair St., St. Paul, Minn.
Engr., Foley Bros., Contractors.

Pause, Harold Arthur 1923 E.
459 Fuller Ave., St. Paul, Minn.
Tri-State Tel. & Tel. Co.

Pavek, William Joseph 1919 M., 1920 M.E.
2312 Kirkland Ave., Chicago, Ill.
Engr., Western Electric Co.

Payne, Harold Gould 1906 E.
12 Reed St., Lexington, Mass.
Engr. with Jackson & Moreland, Consult. Engrs., Boston.

Pearce, John Henry 1907 E.
Address unknown; information requested.

Pearson, Charles W. 1921 E.
Philadelphia, Pa.
Constr. Foreman, General Electric Co.

Pease, Maynard W. 1910 M.
Address unknown; information requested.

Pease, Raymond A. 1912 C., 1913 C.E.
Address unknown; information requested.

Peck, Lloyd 1923 C.
102 Madeline St., Joliet, Ill.
Draftsman, E. J. & E. Ry. Co.

Peckham, Harold E. 1923 M.
1832 Marshall Ave., St. Paul, Minn.
Engr., St. Paul Gas Light Co.

Pengilly, Joseph Hill 1911 E.
1314½ W. 4th St., Los Angeles, Cal.
Brown & Pengilly, Electrical Mfgrs.

Peoples, John S. 1914 M.
514 Lake St., Oak Park, Ill.
Teacher, Oak Park High School.

Peters, Walter Charles 1922 M.
Janesville, Minn.

Peters, William George 1883 C.
Address unknown; information requested.

Peterson, Albert Edward 1919 E.
3157 Washington Blvd. No. 2, Chicago, Ill.
Asst. Efficiency Engr., Commonwealth Edison Co.

Peterson, Albert L. 1914 M., 1915 M.E.
Fargo, N. Dak.

Peterson, A. M. 1914 E.
1196 DeSota St., St. Paul, Minn.

Peterson, Arthur Perry 1919 E.
Room 602, 15 West 37th St., New York City.
Field Repr., Assoc. of Electragists.

Peterson, Barney J. 1912 C., 1913 C.E.
1277 New Hampshire Ave. N. W., Washington, D. C.
U. S. Geol. Survey.

Peterson, Clarence A. 1908 E.
1913 R. E. Ave. N. E., Washington, D. C.
Engr., Office of Supervising Archt., Treasury Dept.

Peterson, George T. 1908 M.
Two Harbors, Minn.
Supervisor of Apprentices, D. & I. R. R. R.

Peterson, Harold Leon 1916 C., 1917 C.E.
2508 Broadway, Indianapolis, Ind.
Asst. Sales Mgr., Nordyke & Marmon Auto Co.

Peterson, Harold Robert 1918 G.
Address unknown; information requested.

Peterson, Harold Waldemar 1921 E.
Address unknown; information requested.

Peterson, Neander Eberhard 1922 C.
Midland, Ky.
Instrument man, Ill. Central R. R.

Peterson, Peter Irvin 1920 E.
Wilmar, Minn.
P. C. Peterson & Sons, Department Store.

Peterson, Richard M. 1920 E.
51 S. 13th St., Minneapolis, Minn.
Power Salesman, Northern States Power Co., St. Paul.

Peterson, Vance C 1920 E.
3493 Brookline Ave., Cincinnati, Ohio.
Engr., Proctor & Gamble Co.

Peterson, William W. 1916 C.
115 6th St. N. W., Minot, N. Dak.
Supt. of Water Works.

Petrich, Alfred Carl 1919 E.
2791 E. 116th St., Cleveland, Ohio.
Sales Repr., Burke Elec. Co., Erie, Pa.

Phelps, Ray R. 1910 E.
Kelso, Wash.
Motor Inn Garage.

Pierson, Joe Willard 1919 E.
1165 So. Oak Park Ave., Oak Park, Ill.
Asst. Engr., Boiler Room, Commonwealth Edison Co.

Pinska, Lawrence F. 1922 C.
1193 Hague Ave., St. Paul, Minn.
Draftsman, L. P. Wolff, Cons. Engr.

Plank, Howard G. 1922 E.
Oconomowoc, Wis.
Toren Restoration Hospital.

Pless, Arnold G. M. 1920 C.
131 Bridge St., Albert Lea, Minn.
Asst. Highway Engr., C. W. Squire.

Plowman, George Taylor 1892 A.
99 Garden St., Cambridge, Mass.
Artist, Etcher.

Podosin, John 1921 E.
533 Park Ave., Omaha, Neb.
Night Supervisor, Plant Dept., N. W. Bell Tel. Co.

Poore, Orson B. 1909 E.
Federal Dam, Cass Co., Minn.
Research Engr.

Poulsen, George Frederick 1917 A.
1455 Randolph St., St. Paul, Minn.
Asst. Mgr., Paul Steenberg Constr. Co.

Powell, Knox Archibald 1920 M.
Pittsburgh, Pa.
Service Engr., Westinghouse Elec. & Mfg. Co.

Powles, James William 1910 E.
928 Osceola Ave., St. Paul, Minn.
Science Teacher, Humboldt High School.

Pratt, Arthur Clarence 1899 E.
817 Diamond St., Butte, Mont.
Chief Operating Elec. Engr., The Montana Power Co.

Pratt, Benjamin A. 1915 C.
717 Delaware St. S. E., Minneapolis, Minn.
Teacher, South High School.

Prendergast, Arthur A. 1903 C.
1620 Laurel Ave., St. Paul, Minn.
Constr. Engr., Sanitor Constr. Co.

***Prendergast, Paul S.** 1900 C.

Prentice, Robert Schaffer 1908 E.
Cincinnati, Ohio.
Salesman, Philip Carey Co.

Price, Clarence R. 1920 E.
St. Louis, Mo.
Sales Engr., Century Electric Co.

Price, John R. 1914 C.
Address unknown; information requested.

Priedeman, George Walter 1908 M.
27 Summit Ave., St. Paul, Minn.
Vice Pres. and Sec., Mpls. Ornamental Iron Co.

Prudden, George H., Jr. 1917 A.
1734 Seward Ave., Detroit, Mich.
Chief Engr., Stout Metal Airplane Co.

Pulver, Richard Fillmore 1923 E.
Cloquet, Minn.
Asst. Elec. Engr., The Northwest Paper Co.

Purdy, Irving Breward 1920 C.
5045 Washburn Ave. S., Minneapolis, Minn.
Engr., Truscon Steel Co.

***Purves, Leland Ernest** 1912 E.

Putnam, George William 1918 G.
1019 W. High St., Jefferson City, Mo.
Sanitary Engr., State Board of Health.

Putz, John Howard 1914 E., 1915 E.E.
Address unknown; information requested.

Quense, John 1901 C., 1902 M.E.
1322 East 63rd St., Seattle, Wash.

Quiggle, Arthur W. 1913 C., 1914 C.E.
1031 15th Ave. S. E., Minneapolis, Minn.
Gen. Mgr., The Creamette Co.

Quinn, John I. 1908 C.
212 Court House, Duluth, Minn.
Bridge Engr., St. Louis County.

Rader, Clarence McKinley 1917 C., 1917 C.E.
Casper, Wyo.
Petroleum Engr., Midwest Refining Co.

Ramm, Theodore Deertz 1913 E.
2135 Logan Ave., Youngstown, Ohio.
Asst. Elec. Engr., Penn.-Ohio Power & Lt. Co.

Ramstad, Edward Carl 1902 M.
Address unknown; information requested.

Rand, Lars 1912 M., 1913 M.E.
Address unknown; information requested.

Rank, Samuel Adison 1875 C.
1929 Walnut St., Boulder, Colo.

Rankin, Renville S. 1914 C.
295 Ashland Ave., River Forest, Ill.
First Asst. Engr., Pearse, Greeley & Hansen.

Ransom, Glen Bolger 1922 E.
525 16th Ave. S. E., Minneapolis, Minn.
Engr., Amer. Tel. & Tel. Co.

Ransom, Ralph W. 1923 M.
403 West 10th St., Sioux Falls, So. Dak.
Asst. Engr., John Morrell Packing Plant.

Rask, Louis Gilbert 1903 E.
14 Alvey St., Schenectady, N. Y.
Engr., Marine Eng. Dept., General Electric Co.

Rath, Harvey C. 1923 E.
2304 Hoagland Ave., Fort Wayne, Ind.
Transformer Engr., General Electric Co.

Raugland, Arnold I. 1920 A.
4213 Park Ave., Minneapolis, Minn.
Lang, Raugland & Lewis, Archts. & Engrs.

Rawson, Ralph Harvey 1907 M.
892 East 29th St. N., Portland, Ore.
Goss & Rawson, Cons. Timber Engrs.

Reardon, John Melvin 1922 C.
978 Selby Ave., St. Paul, Minn.
Engr., Butler Bros. Bldg. Co.

Reasoner, Clayton Madison 1920 M.
303 Walnut St. S. E., Minneapolis, Minn.
Eng. Dept., Washburn-Crosby Co.

Reed, Albert Irving 1885 C.
456 Webster Place, Milwaukee, Wis.
Asst. Engr., U. S. Engrs. Office.

Reed, Arthur Lathrop 1906 C.
Anoka, Minn.
Pres., Reed & Sherwood Mfg. Co.

Reeve, Charles Hubert 1919 E.
Hibbing, Minn.
Instructor in Elec. Engr., Hibbing High School and Junior College.

Reid, Harry A. 1910 E.
Cleveland, Ohio.
National Electric Lamp Assoc.

Reidhead, Frank Erven 1893 E., 1898 E.E.
2305 Portland Ave. So., Minneapolis, Minn.
Engr., Dept. of Bldgs., City of Minneapolis.

Reuter, Peter Theodore 1921 M.
1852 E. 73rd St., Cleveland, Ohio.
Cadet Engr., Bailey Motor Co.

Reque, Styrk G. 1901 E.
2710 Greenleaf St., Allentown, Pa.
Chief Engr., Penn. Power & Light Co.

Rezab, John Joseph 1907 E.
916 Ontario St., Oak Park, Ill.
Asst. Engr., Public Service Co., Chicago, Ill.

Rhame, Paul W. 1920 M.
Flint, Mich.
Supt. of Inspection, A. C. Spark Plug Co.

Richardson, Wilbur Percy 1899 M.
622 Grand Ave., St. Paul, Minn.

Riedesel, George M. 1917 A.
210 1st Ave. No., Crookston, Minn.
Opera Bldg., Crookston, Minn.

Riegel, Louis F. 1911 E.
1128 East 32nd St., Savannah, Ga.
Sales Agent, Savannah Electric Power Co.

Rickman, Herman W. 1917 C.
967 E. 62nd St., Chicago, Ill.
Structural Designer, Sargent & Lung.

Ringsred, Arthur Christian 1906 M.
319 W. 4th St., Duluth, Minn.
Engr., Duluth, Minn.

Ringstrom, Ivan G. 1912 E., 1913 E.E.
1859 Roblyn Ave., St. Paul, Minn.

Ritchie, John Reid 1916 M., 1917 M.E.
4841 Vincent Ave. So., Minneapolis, Minn.
Engr., Enterprise Mach. Co.

Robbins, Orison B. 1903 C.
1901 D St. N. W., Washington, D. C.
Asst. Bridge Engr., Interstate Commerce Commn.

Roberts, Earl Hovey 1915 M., 1916 M.E.
3309 Wells St., Milwaukee, Wis.
Asst. to Secy., Home Real Estate & Invest. Co.

Robertson, Burton T. 1914 E., 1915 E.E.
10 Sidney Place S. E., Minneapolis.
Asst. Prof. of Mechanical Engineering, Univ. of Minn.

Robertson, Charles N. 1908 C.
New Ulm, Minn.
Highway Engr. of Brown Co.

***Robertson, Soren Martin** 1913 M.

Robison, Archer R. 1909 E.
43 Exchange Place, New York City.
Cons. Supt., J. G. White Eng. Corp.

Rockwell, Harvard S. 1914 C.
3308 Dupont Ave. So., Minneapolis, Minn.
Struct. Engr., Schuett-Meier Co., St. Paul, Minn.

Rockwood, Fletcher 1914 M., 1915 M.E.
320 Prospect Ave., Minneapolis, Minn.
Asst. Secy., Wells-Dickey Trust Co.

Roe, Harry Burgess 1908 G.
1511 Chelmsford St., St. Paul, Minn.
Assoc. Prof. of Drainage, Farm School, Univ. of Minn.

Roeske, Otto Bismarck 1906 E.
Washington, D. C.
Principal Examiner, U. S. Patent Office.

Rolfe, West Alfred 1913 C.
Address unknown; information requested.

Rome, Robert C. 1922 E.
Omaha, Nebraska.
Traffic Engr., Northwestern Bell Telephone Co.

Romero, Cirilo Luis 1917 M., 1918 M.E.
Central Moron, Pina, Prov. of Camaguey, Havana, Cuba.
Asst. to Div. Engr., Eastern Cuba Sugar Corp., Havana.

Rood, Arnold Ellsworth 1922 E.
302 Milwaukee St., Whitewater, Wis.

Rood, Olaf Tjelle 1922 M.
Died at La Grange, Illinois, April 9, 1924.

Rose, Norman W. 1906 M.
1117 1st St. E., Duluth, Minn.
Minnesota Steel Co., New Duluth.

Rosenbloom, Abraham E. 1917 M.
Address unknown; information requested.

Rosendahl, Harold R. 1922 M.
123 N. Negley Ave., Pittsburgh, Pa.
District Mgr., Mahr Mfg. Co.

Rosenthal, Oscar Leonard 1919 C.
Arkansas City, Kansas.
Production Engr., Roxana Petroleum Corp.

Rosenthal, Paul 1922 C.
Havana, Cuba.
Inspector American Bridge Co.

Rosok, Ingwald A. 1903 E.
Bisbee, Ariz.
Chief Electrician, Bisbee Improvement Co.

***Rosok, Peter A. Marius** 1904 E.

Ross, Russell Harding 1918 E.
1830 Jefferson St., Duluth, Minn.
Asst. to Elec. Engr., S. W. L. & P. Co., Superior, Wis.

Roth, Lewis Mitchell 1911 C.
612 Lincoln, St. Paul, Minn.
Sales Mgr., Kalman Steel Co.

Rothi, Paul 1904 C.
Mitchell, Neb.
Irrigation Engr., U. S. Reclamation Service.

Rounds, Fred M. 1895 E.
4118 Rawline St., Dallas, Texas.
Bldgs. and Supplies Supt., S. W. B. Tel. Co.

Roy, Milo Chapin 1921 M.
Y. M. C. A., Duluth, Minn.
Salesman, Fairbanks Morse & Co.

Ruemmele, A. E., 1912 M., 1913 M.E.
168 Eugenie St., Chicago, Ill.
Designer, Checker, Freyn Brassert & Co.

Rufsvold, Olav Martin 1915 C., 1916 C.E.
1430 Spruce Place, Minneapolis, Minn.
Bridge Designer, Minn. State Highway Dept., St. Paul, Minn.

Russell, Carl Austin 1916 E.
Address unknown; information requested.

Russell, Winfred W. 1923 E.
4518 No. Racine Ave., Chicago, Ill.
Transmission Tester, Ill. Bell Tel. Co.

Ryan, Loiel S. 1912 C., 1913 C.E.
310 2nd St. S. E., Little Falls, Minn.
Mgr., Ryan Wholesale & Retail Hardware Co.

Ryan, Robert Marcus 1923 E.
615 12th Ave. S. E., Minneapolis, Minn.
Eng. Dept., Northern States Power Co.

Ryan, William Thomas 1905 E.
116 Melbourne Ave., Minneapolis, Minn.
Prof. of Elec. Power Eng., Univ. of Minn.

Rydeen, Francis G. A. 1905 M.
Knob Lick, Mo.
Merchant.

Salisbury, Willis R. 1910 C.
2416 W. 24th St., Minneapolis, Minn.
Secy. and Asst. Supt., Salisbury & Satterlee Co., Machy.

Sampson, Clifford L. 1923 E.
911 E. 17th, Minneapolis, Minn.
Teaching Fellow in Elec. Eng., Univ. of Minn.

Sander, Theodore, Jr. 1919 E.
459 Fuller Ave., St. Paul, Minn.
St. Paul Association of Public Affairs.

Sannicolo, Joseph Felix 1922 E.
1191½ Grant Ave., Eveleth, Minn.
Asst. to Civil Engr., Virginia, Minn.

Satori, Roy Herbert 1921 E.
Schenectady, New York.
Engr., Testing Dept., General Electric Co.

Sauer, Arthur Albert 1923 C.
North St. Paul, Minn.
Draftsman, Toltz, King & Day, Engrs. and Archts.

Sausen, B. R. 1913 M.
3120 Carroll Ave., Chicago, Ill.
Chief Engr., Binks Spray Equipt. Co.

Savage, Edward S. 1897 M.
215 Dartmouth St., Rochester, N. Y.
Mech. Engr., Shinola Co.

Sawyer, Emerson D. 1910 C.
409 E. Spruce St., Sault Ste Marie, Mich.

Schaller, George C. 1923 C.
3347 Aldrich Ave. So., Minneapolis.
James Leck & Co., Archts. & Engrs.

Schildt, William F. H. 1908 E.
General Electric Co., Buffalo, N. Y.

Schlattman, Edward Charles 1908 C.
Alberta, Minn.
Farming.

Schlenk, Hugo, Jr. 1918 E.
955 Portland Ave., St. Paul, Minn.
Chemist, St. Paul Gas Light Co.

Schlenk, John J. 1923 C.
Fond Du Lac, Minn.
Field Eng. Dept., Phoenix Utility Co.

Schmid, Robert John 1908 C.
716 Laconia Place, Los Angeles, Cal.
Appraiser, Union Bank & Trust Co.

Schoepf, Alfred Walter 1908 E.
501 1st St., Fairmont, West Va.
Elec. Engr., Monongahela Power & Ry. Co.

Schottler, George Jesse 1923 E.
1312 Farragut St. N. W., Washington, D. C.
Asst. Examiner, U. S. Patent Office.

***Schow, Harry Albert** 1906 E.

Schow, William P. 1907 E.
8809 17th Ave. S. E., Seattle, Wash.

Schroeder, Carl W.
1914 E., 1915 E.E.
49 Clark St., Patterson, N. J.

Schulz, Elton Albert 1916 E.
1472 Breda Ave., St. Paul, Minn.

Schumacher, John Henry 1903 E.
1056 Sherburn St., Winnipeg, Can.
Vice Pres. and Mgr., Schumacher Gray Co.

Schwartz, John Saul 1919 A.
5834 Calumet Ave., Chicago, Ill.
Designer, Geo. W. Maher & Son, Archts.

Schwedes, Walter Frederick 1906 E.
2801 Branch St., Duluth, Minn.
Elec. Engr., Oliver Mining Co.

Schweiso, Clifford C. 1923 E.
3905 10th Ave. So., Minneapolis.
Northern States Power Co.

Sclarow, Abraham 1923 C.
1402 8th Ave. No., Minneapolis.

Scobie, Francis George 1908 E.
4231 Robinson St., Duluth, Minn.
Master Mechanic, Philadelphia & Reading Coal Co., Superior, Wis.

Scott, Elmer C. 1915 C., 1916 C.E.
R. F. D. No. 3, Minneapolis, Minn.
Ford Dealer.

Scott, Herbert Leslie 1923 E.
1322 Lowry Ave. N. E., Minneapolis, Minn.
Exchange Engr., Northwestern Bell Tel. Co.

Scott, Willard W. 1917 E.
Address unknown; information requested.

Sear, Arthur W. 1923 M.
432 Clement Ave., Milwaukee, Wis.
Draftsman, Nordberg Mfg. Co.

Sears, Dow Irving 1914 C.
500 Lake St., Ironwood, Mich.
Supt., Water Department.

Seemann, Ernest Warren 1920 C.
102 Madeline St., Joliet, Ill.
Office of Chief Engr., E. J. & E. R. R.

Seuander, Karl William 1922 E.
Chicago, Ill.
Ill. Bell Tel. Co.

Sheffield, Fred Will 1909 C.
357 7th Ave. So., Fargo, N. Dak.
Vice Pres., Fargo Bridge & Iron Co.

Shellenberger, Hiram R. 1920 M.
Bombay, India.
Lubricating Engr., Standard Oil Co. of New York.

Shenehon, Francis C.
1895 C., 1900 C.E.
2109 Blaisdell Ave., Minneapolis.
Cons. Hyd. Engr.

Shepard, Burchard Post 1895 M.
680 Clackamos St., Portland, Ore.
Osteopath.

Shepard, Donald D. 1911 E.
143 Lafayette Blvd., Detroit, Mich.

Shepard, George Milson 1909 C.
1084 St. Clair St., St. Paul, Minn.
City Engr., St. Paul, Minn.

Shepley, Charles Rogers 1902 C.
2607 Chicago Ave., Minneapolis.
General Contr. and Engr.

Sherwood, Edward Burdette 1920 C.
Glenwood, Minn.
Inspector, Minn. State High. Dept.

Shippam, Willis 1909 M.
1115 Forest Ave., Ann Arbor, Mich.
Asst. Prof. of Military Science, Univ. of Mich. Major, Coast Artillery U. S. Army.

Shuck, Gordon Russell 1906 E.
4741 7th Ave. N. E., Seattle, Wash.
Asst. Prof. of Electrical Eng., Univ. of Wash.

Shuirman, Gabe 1921 E.
Keewatin, Minn.
Supt., Water, Light, Power & Bldg. Comm.

Shumway, Ernest J. 1900 E.
Robbinsdale, Minn.
Electrical Contr.

Sickel, Edwin Charles 1923 E.
1028 E. Lawson, St. Paul, Minn.
Eng. Dept., St. Paul Gas Light Co.

Siegmann, Chester W. 1920 E.
2651 13th Ave. So., Minneapolis.

Silliman, Henry Dickinson 1897 M.
4318 10th Ave. N. E., Seattle, Wash.
City Engr's Office.

Silverman, Emil Mark 1922 C.
37 Dixon Nat'l Bank Bldg., Dixon, Ill.
Highway Engr., State of Ill.

Sime, Theodore L. 1923 A.
1927 Carroll Ave., St. Paul, Minn.
Draftsman, Colburn & Forsell, Archts.

Simmon, Karl Albert, Jr. 1905 E.
215 Elm St., Edgewood, Pittsburgh.
Mgr., Light Traction Div., Westinghouse Elec. & Mfg. Co.

Simmonds, Richard Roy 1921 C.
P. O. Box 311, Escanaba, Mich.
Resident Engr., Mich. State Highway Dept.

Simons, Walter Wallenau 1916 E.
158 N. Walnut St., East Orange, N. J.
Sales Dept., Western Elec. Co., New York, N. Y.

Siverson, Sigvel John 1911 C.
3100 43rd Ave. So., Minneapolis.
Contr. and Engr., S. J. Siverson Co.

Siverts, Samuel Andrew, Jr. 1909 C.
2729 Colfax Ave. So., Minneapolis.
Cons. Engr.

Skagerberg, Rutcher
1915 E., 1916 E.E.
1 Walnut St., Hudson Falls, New York.
Engr., American Blower Co., Detroit, Mich.

Skon, Herman William
1915 M., 1916 M.E.
1339 Searle St., St. Paul, Minn.
Automotive Repair Shop.

Skurdalsvold, Peter
1915 C., 1916 C.E.
2726 Dupont Ave. So., Minneapolis.
Traffic Engr., Twin City Rapid Transit Co.

Skytte, Ernest E. 1910 E.
Westinghouse Elec. & Mfg. Co., Pittsburgh, Pa.

Slade, Loring 1922 C.
Peterson, Minn.
Draftsman, Minn. Highway Dept.

Smart, George Alfred 1916 M.
814 Farree St., Cavapolis, Pa.
Pittsburgh Knife & Forge Co.

Smit, Catherine 1922 A.
486 Portland Ave., St. Paul, Minn.

Smith, Byron Elton 1907 E.
Chief Engr., Granite Gold Mining Co., Valdez, Alaska.

Smith, Cedric Burnett
1914 B.A., 1918 C.
2041 West 98th St., Chicago, Ill.
Adv. Mgr., Chicago Bridge & Iron Works.

***Smith, Clinton Besly** 1905 E.

Smith, Donald C. 1918 E.
401 W. 118th St., New York City.
Engr., American Tel. & Tel. Co.

Smith, Donald Tidd 1905 C.
400 Oak Cliff Blvd., Dallas, Tex.
T. & P. Ry. Bldg.

Smith, Hugh Adams 1918 E.
215 East Jefferson St., Boise, Idaho.
Div. Engr., Idaho Power Co.

Smith, Leighton Herbert 1903 C.
Ottumwa, Ia.
Pacific Mutual Life Ins. Co.

Smith, Louis Oville 1883 C.
Address unknown; information requested.

Smith, Paul Sherburne 1903 C.
Strathmore, Cal.
Orange Ranch.

Smith, Sidney H. 1911 C.
Mitchell, S. Dak.
Smith & Reeves, Civil Engrs.

***Smith, William Carpenter** 1890 C.

Smithson, John Edward 1907 E.
Hood River, Ore.
Pres. and Gen. Mgr., Oregon-Wash. Tel. Co.

Smolensky, Martinian G. 1918 C.
Address unknown; information requested.

Sneve, Jack Stickney 1911 M.
2822 E. 1st St., Duluth, Minn.
Mgr., Joy Bros. Motor Car Co.

Snow, Clarence J. 1914 M., 1915 M.E.
411 Cedar Ave., Minneapolis, Minn.

Sommerfeld, Adolph A. 1910 C.
1319 Edmund St., St. Paul, Minn.

Sorenson, John Elmer 1922 E.
1318 7th St. S. E., Minneapolis.

Soshnik, Edward Joseph 1922 C.
Minneapolis, Minn.
Struct. Engr.

Souba, William Henry 1909 M.
24 Maudsley Court, Port Arthur, Ont., Canada.
C. D. Howe & Co., Cons. Engrs.

Soulek, Joseph Henry 1911 E.
Montgomery, Minn.
General Merchandise Business.

South, Willard A. 1912 C., 1913 C.E.
251 Cecil St. S. E., Minneapolis.
Vice Pres., Jas. H. Brown Co.

Souther, Morton Edwin
1912 C., 1913 C.E.
1528 Branston St., St. Paul, Minn.
Souther & MacIntyre, Minneapolis.

Spence, William James 1902 E.
348 Hingston Ave., Montreal, Can.
Engr., Northern Elec. Co., Ltd.

Spencer, Raymond D. 1923 C.
680 E. St., San Bernardino, Cal.
Engr., Cal. Highway Comm.

Sperry, Leonard B.
1905 M., 1908 E.E.
Western Springs, Ill.
Chief Engr., Tractor Engineering, International Harvester Co.

Spring, Willis Ware 1907 M.
2022 E. 2nd St., Duluth, Minn.
Mgr., Service Dept., Northern Nat'l Bank.

Springer, Frank Wesley
1893 E., 1898 E.E.
127 Orlin Ave. S. E., Minneapolis.
Prof. of Elec. Eng., Univ. of Minn.

***Stacy, Elmer Neill** 1907 M.

Staehle, Gilbert C. 1920 C.
2730 Portland Ave., Minneapolis.
Cons. Engr., 529 2nd Ave. S.

Stanius, Godfrey 1921 E.
3023 18th Ave. S., Minneapolis.
Mech. Engr., Baker Valve Co.

Stanton, Raymond E. 1904 M.
1625 Ashland Ave., St. Paul, Minn.
R. E. Stanton Equipment Co.

Starrett, Howard M. 1909 M.
Fairmont, Minn.
Supt., Fairmont Railway Motors, Inc.

Steffens, Robert Aresene 1922 E.
327 Pitt St., Wilkinsburg, Pa.
Westinghouse Elec. Co.

Stenger, Laurence A. 1906 E.
840 S. Clarkson St., Denver, Colo.
Engr., Research Dept., Great Western Sugar Co.

Stephens, Clifford 1923 E.
3615 Fremont Ave. N. Minneapolis.

Stephenson, Oliver H. 1907 M.
3649 Aldrich Ave. S., Minneapolis.
Supt. of Maintenance, Washburn-Crosby Milling Co.

Sternberg, Carl 1907 E.
1714 Elliot Ave. S., Minneapolis.
Electric Machy. Co.

Stewart, Clarence H. 1903 C.
2214½ Fourth Ave., Hibbing, Minn.
Appraisal Engr., Chas. Foster, Cons. Engr., Duluth.

Stewart, Garnet 1922 A.
1008 Selby Ave., St. Paul, Minn.

***Stewart, J. Clark** 1875 C.

Stewart, Newton Prescott 1896 Ex.
409 Orchard St., Cranford, N. J.
Pres., The National List, Inc.

Stillman, Marcus H. 1909 E.
87 Main St., St. Johnsbury, Vermont.
Asst. Factory Supt., E. & T. Fairbanks & Co.

Stinson, Will V. 1911 E.
Westinghouse Elec. Co., Pittsburgh, Pa.

Stone, Charles Willington
1916 M., 1917 M.E.
3432 Chicago Ave., Minneapolis.
Niles Bement Pond Co., St. Paul.

Stone, Harris Garfield 1906 E.
5959 Yucca St., Los Angeles, Cal.
Elec. Contr. and Dealer, Hollywood, Cal.

Stone, Melvin O. 1902 M.
Address unknown; information requested.

Stoutland, Oliver Andrew 1922 C.
2944 38th Ave. S., Minneapolis.
Struct. Estimator, Minneapolis Steel and Mach. Co.

Strate, Thomas Henry 1901 C.
6246 Greenview Ave., Chicago, Ill.
Engr. of Track Elevation, C. M. & St. P. Ry., Evanston, Ill.

Streich, Harry C. 1912 E.
25 E. 5th St., St. Paul, Minn.

Strom, Arthur 1923 A.
1643 Farragut Ave., Chicago, Ill.
Draftsman for Carl W. Westerlind, Archt.

Strothman, Russell Adolph 1920 E.
542 W. 112th St., Apt. 7a, New York City.
Engr., American Tel. and Tel. Co.

Sturtevant, Percy G. 1908 E.
934 W. 31st St., Erie, Pa.
Operating Dir., Erie County Elec. Co.

Stussy, William 1900 E.
916 West Platinum St., Butte, Mont.
Engr., Montana Power Co.

Sudheimer, Edward Lawrence
1902 M.
990 Ashland Ave., St. Paul, Minn.
Cons. Engr.

Sushan, Harry Michael 1919 C.
367 Fulton St., Brooklyn, N. Y.
Engr. and Archt.

Sutherland, Samuel Joseph 1923 Ae.
3418 Emerson Ave. S., Minneapolis.
Asst. Supt., Minnesota Stadium, for F. M. Mann, Archt.

Svendsen, George Peter 1908 E.
99 Thomas Ave. N., Minneapolis.
Pres. and Gen. Mgr., Boustead Elec. & Mfg. Co.

Sverdrup, Leif John 1921 C.
Box 372, Waverly, Mo.
Field Bridge Engr., Missouri Highway Comm., Jefferson City, Mo.

Swanson, Clifford LeRoy 1922 C.
1716 Tyler St. N. E., Minneapolis.
Designer and Estimator, Corrugated Bar Co., Inc.

Swanson, Edwin Walter 1919 E.
Hopkins, Minn., R. 3.
Switchboard Engr., Electric Mach. & Mfg. Co.

Swanson, Paul H. 1923 C.
1926 So. 52nd St., Chicago, Ill.
Draftsman, Concrete Engineering Co.

Swanson, Philip G. 1923 M.
1115 4th St. S. E., Minneapolis. Minn.
Engr., Chicago Pneumatic Tool Co.

Swanstrom, Frank N. 1908 E.
4017 Oakland Ave., Minneapolis, Minn.
Chief Engr., Electric Machy. Co.

Swedberg, Marcus Roy 1911 C.
935 17th Ave. S. E., Minneapolis, Minn.
Contr. Agent, W. D. Lovell, Contr.

Sweet, Ray Rennington 1921 E.
4410 W. Lake Harriet Blvd., Minneapolis, Minn.
Chief Engr. of WLAG Station, Cutting & Washington Radio Corp.

Sweningsen, Oliver 1908 E.
3509 Nieto St., Long Beach, Cal.
Div. Methods Engr., Pacific Tel. & Tel. Co., Los Angeles, Cal.

Swenson, Charles August 1907 C.
Atwater, Minn.
Practicing Attorney.

Swenson, Clarence Q.
1917 M., 1920 M.E.
50 W. Euclid Ave., Detroit, Mich.
Supt., Detroit Heat Treating Co.

Swenson, George W.
1917 E., 1921 E.E.
99 Bedford St. S. E., Minneapolis.
Instructor in Elec. Eng., University of Minnesota.

Swenson, Gustav A. 1920 G.
2842 31st Ave. S., Minneapolis.

Swenson, H. Seymour
1912 C., 1913 C.E.
Ogden Hotel, 12th and LaSalle, Minneapolis, Minn.
Sales Engr., The Hustad Co.

Swenson, Karl P.
1907 E.M., 1909 G.
100 West 59th St., New York City.
Oriental Mgr., Allied Mach. Co. of America.

Swenson, Oscar E.
1915 C., 1916 C.E.
51 Seminole Parkway, Buffalo, N. Y.
Chief Engr., Lackawanna Bridge Works Corp.

Swenson, Theodore J. Miner, 1912 E.
108 Leech St., St. Paul, Minn.
Statistician, Office of Pres., N. P. Ry.

Swift, George Earl 1923 E.
1514 2nd Ave. S., Minneapolis, Minn.
Test Course, Electric Mach. & Mfg. Co.

Talbot, Thomas Franklin 1918 E.
2408 South Figueroa St., Los Angeles, Cal.
Designing Engr., Southern Cal. Edison Co.

Tallmadge, Everett Spencer
1914 E., 1915 E.E.
373 Robert St., St. Paul, Minn.
Pres. & Treas., Commonwealth Appliance Co.

Tallmadge, Hiram
1916 E., 1917 E.E.
Grand Rapids, Mich.
Constr. Engr., Mich. Contr. and Highway Co.

Tannehill, Louis William 1916 A.
3934 Portland Ave., Minneapolis.
Mech. Draftsman, Board of Education.

***Tanner, Harry L.** 1895 E.

Taplin, Robert Baird 1904 E.
Address unknown; information requested.

Tarbell, William Park 1922 C.
1144 College St., Fargo, N. D.
Engr., Sewer & Water Dept.

Taylor, Duane Leroy 1917 M.
San Francisco, Cal.
Lieut., U. S. Navy, U. S. S. Idaho.

Taylor, Edward Walter D. 1898 C.
139 E. 7th St., Claremont, Cal.
Prof. of Mechanics, Pomona College.

Taylor, Lyman David
1913 E., 1916 E.E.
8415 Euclid Ave., Cleveland, Ohio.
Electric Controller & Mfg. Co.

Taylor, Ralph George 1902 M.
Address unknown; information requested.

Teberg, Ernest John
1916 E., 1917 E.E.
1905 Maple Ave., Evanston, Ill.
Mgr., Illuminating Contract Dept., Public Service Co., Chicago.

Teberg, Lawrence E. 1922 C.
222 Arundel St., St. Paul, Minn.
Draftsman and Designer, G. N. R. R.

Tennstrom, Carl H. 1923 C.
1112¼ East 2nd St., Duluth, Minn.
Hydrographer, Phoenix Utility Co.

Thaler, James Auken 1900 E.
Bozeman, Montana.
Prof. of Elec. Eng. State College of Agr. & Mech. Arts.

Thayer, Charles Edward 1876 C.
818 Mt. Curve Ave., Minneapolis.
Secy. and Treas., Electric Steel Elevator Co.

Thayer, Paul W. 1914 M., 1915 M.E.
Newton, Iowa.
Engr., American Gas Construction Co.

Thomas, William A. 1917 E.
4033 Columbus Ave., Minneapolis.
Engr., Toltz, King & Day, Inc., St. Paul.

Thompson, Claudius A. 1922 C.
Two Harbors, Minn.
Inspector, Minnesota Highway Dept.

Thompson, Everett 1923 C.
3534 22nd Ave. S., Minneapolis.
Structural Draftsman, Minneapolis Steel and Mach. Co.

Thompson, Harry T. 1915 E., 1916 E.E.
3337 W. 88th St., Cleveland, O.
Sales Engr., Wagner Electric Mfg. Co.

Thompson, Herbert Leslie 1912 M.
Rio de Janeiro, S. A.
International Steam Pump Co.

Thompson, Jesse Lysander 1916 E., 1917 E.E.
2510 H St., Bakersfield, Cal.
Inspector of Sub-stations, San Joaquin Light and Power Corp.

Thompson, Roy Edwin 1900 E.
115 Penn Ave., San Diego, Cal.
Purchasing Agent, San Diego Cons. Gas & Elec. Plant.

Thorne, Donald E. 1923 E.
2826 Ruckle St., Indianapolis, Ind.
Eng. Apprentice, Western Union Tel. Co.

Thorshov, Olaf 1921 A.
19 Seymour Ave. S. E., Minneapolis, Minn.
Long & Thorshov, Archts. and Engrs.

Thuras, Albert Laurie 1912 E., 1913 E.E.
332 North Maple Ave., East Orange, N. J.
Research Engr., Western Electric Co., New York City.

Thurston, Harold Hutchins 1913 C., 1914 C.E.
Rubicon, Wis.
Const. Supt., Colburn, Thurston Co., Highway Contrs.

Tierney, Festus P. 1922 C.
Stillwater, Minn.

***Tilderquist, William Magnus,** 1895 M.

Timperley, William Daniel 1910 C.
2422 Garfield St. N. E., Minneapolis.
Contr. Engr., Crown Iron Works Co.

Todd, Milo E. 1909 E.
4400 Thomas Ave. S., Minneapolis.
Asst. Prof. of Elec. Eng., University of Minnesota.

Tomlinson, L. C. 1904 E.
454 Lincoln St., Franklin, Mass.

Tondell, Mandell 1907 C.
730 E. Superior St., Duluth, Minn.

Torgerson, Irving Eugene 1912 C., 1913 C.E.
99 Dirisadero St., San Francisco, Cal.
Asst. Engr., Bridge Dept., Southern Pacific Co.

Torrance, Eli 1909 C.
5050 Dupont Ave. S., Minneapolis.
Dept. Mgr., Thorpe Bros., Realtors.

Towle, Neal C. 1912 E., 1913 E.E.
1801 Union Bank Bldg., Pittsburgh.
Salesman, Westinghouse Elec. & Mfg. Co.

***Tracy, Fred G.** 1900 E.

Trask, Alfred Shuey 1923 E.
619 Hampton Ave., Wilkinsburg, Pa.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Trask, Birney Elias 1890 C., 1894 C.E.
3820 Aldrich Ave. S., Minneapolis.
Contractor.

Triem, Ralph Hamilton 1920 E.
427 Second Ave. S. E., Minneapolis.
Electrician, Elec. Mach. & Mfg. Co.

Tryon, Philip Dorn 1917 C.
2115 Girard Ave. S., Minneapolis.
Asst. Credit Mgr., Washburn-Crosby Co.

Tubby, Oliver G. 1907 M.
3641 Clement St., San Francisco.
Engr., The Foundation Co. of New York.

Tuck, George Albert 1905 M.
578 19th Ave., San Francisco, Cal.
Pres., Atlas Heating & Ventilating Co.

Tullar, Charles Edward 1901 E.
52 Washington Road, Scotia, N. Y.
Patent Attorney, General Elec. Co.

Tupper, Charles E. 1915 M.
3433 Portland Ave., Minneapolis.
Asst. Treas., N. W. Ice Cream Co.

Turner, Leslie E. 1909 E.
1120 Hinman Ave., Evanston, Ill.
Chicago Mgr., Master Heat Regulator Co.

Turner, Roy H. 1915 E., 1916 E.E.
2274 Carter Ave., St. Paul, Minn.
Engr., Woolery Machine Co., Minneapolis.

Turnquist, Axel Albin 1916 E., 1917 E.E.
413 Monroe St., Eveleth, Minn.
Elec. Contractor, Duluth, Minn.

Tuve, George Lew, 1920 M., 1921 M.E.
1034 14th Ave. S. E., Minneapolis.
Instr. in Mechanical Eng., University of Minnesota.

Tuve, Merle A. 1922 E.
Instr. in Physics, Princeton Univ.

Udell, Carl D. 1909 M.
1315 Taberman St., Los Angeles.
Draftsman, Bureau of Power and Light.

Umbehocker, Frank 1921 M.
108 Pleasant St., Joliet, Ill.
Fuel Engr., Public Service Co.

Ungerman, Carl Mugg 1906 E.
4516 Zenith Ave. S., Minneapolis.
Switchboard Engr., Boustead Elec. & Mfg. Co.

Uzzell, George Walter 1907 E.
Salt Creek, Wyo.
Ohio Oil Co.

Vallacher, Theodore Leif 1920 G.
3709 26th Ave. S., Minneapolis.
Field Draftsman, Ralph D. Thomas, Engr.

Van Cleve, Horatio Phillips 1907 C.
11 Burchfield Ave., Cranford, N. J.
Asst. Engr., J. Edward Ogden Co., Inc., New York City.

***Vaughn, Zenos Newton** 1884 Eng.

Vaule, Sven Alfred 1921 M.
2117 Kenwood Pkwy., Minneapolis.
Consultant, Grice Assoc. Industrial Engrs.

Villaume, Walter F. 1923 C.
103 Buell Ave., Joliet, Ill.
Draftsman and Designer, E. J. & E. Ry. Co.

Vincent, Jay Carter 1903 E.
4733 Lyndale Ave. S., Minneapolis.
Elec. and Mech. Engr., City Engineer's Office.

Vita, Theodore 1909 E.
Address unknown; information requested.

Von Rohr, Herbert Hugo 1921 M.
3644 1st Ave. S., Minneapolis.
Chalmers Oil Burner Co.

Von Schlegell, Frederick 1895 E.
360 Congress Place, Pasadena, Cal.

Waby, Delton Thomas 1923 M.
1165 So. Oak Park Ave., Oak Park, Ill.
Grad. Course, Chicago Central Station Inst.

Wagner, Adolph 1898 E.
617 North Capitol Ave., Indianapolis, Ind.
H. T. Electric Co.

Wagner, Otto H. 1907 M.
Pres., Stacy-Bates Co., Minneapolis.

Wahlquist, Hugo William 1921 E.
3244 Emerson Ave. S., Minneapolis.
Elec. Estimator.

Walby, Arthur Carl 1911 C.
950 23rd Ave. N. E., Minneapolis.

Waldron, Ralph Emerson 1920 E.
620 Oak St., Medford, Ore.
Engr., The Cal-Oregon Power Co.

Walker, Frank Bates 1897 C.
86 Bartlett Road, Winthrop, Mass.
Chief Engr., Eastern Mass. Street Ry., Boston, Mass.

Walker, George William 1908 C.
Thief River Falls, Minn.
Chief Engr., Red Lake Drainage & Conservancy.

Walker, William A. 1911 E.
2116 College Ave., Indianapolis, Ind.
State Repr., Gilbert & Barker Manufacturing Co., Springfield, Mass.

Wallfred, John E. 1920 M.
4554 Wentworth Ave. S., Minneapolis, Minn.
Engr., Northwestern Tel. Co.

Walling, Benjamin Bennett 1909 E.
5038 Dupont Ave. S., Minneapolis.
Realtor with Confer Bros., Inc.

Walquist, John Albert 1923 A.
2528 Elliot Ave., Minneapolis, Minn.
Draftsman, Lang, Raugland & Lewis, Archts.

Walsh, James 1908 M., 1909 E.E.
Address unknown; information requested.

Wangaard, Oscar Henry 1912 C., 1913 C.E.
3145 Elliot Ave., Minneapolis, Minn.
Arch. Engr., Minneapolis Public Schools.

Ward, Alvin C. 1923 E.
6639 W. 34th St., Berwyn, Ill.
Western Elec. Co., Chicago, Ill.

Washburn, Delos Cuyler 1893 A.
Minneapolis, Minn.
Struct. Engr., Minneapolis Steel & Mach. Co.

Watson, Fred Oconor 1916 C.
2516 Harriet Ave., Minneapolis.
Secy., Madsen Constr. Co.

Weatherill, Cedric S. 1914 C., 1915 C.E.
515 So. 1st St., Askaloose, Ia.
Asst. Engr., M. & St. L. R. R.

Weaver, Albert C. 1895 M.
Address unknown; information requested.

Weber, Erwin L. F. 1906 E., 1908 M.E.
3046 18th Ave. S., Seattle, Wash.

Webster, Donald William 1913 C., 1914 C.E.
1838 Ashland Ave., St. Paul, Minn.
Asst. Constr. Engr., Minn. Highway Dept.

Webster, Harry Merle 1915 E.
108 Bellevue Road, Lynn, Mass.
Instructor, English High School.

Weeks, William Charles 1894 C.
Address unknown; information requested.

Weibler, William Mathias 1908 E.
2466 N. 47th Ave., Omaha, Neb.
Equipment Engr., Northwestern Bell Tel. Co.

Weigel, Howard N., 1914 C., 1915 C.E.
124 Prospect Ave., Washburn Park, Minneapolis, Minn.
Contr. Engr., Minneapolis Steel & Mach. Co.

Weinke, Ernest H., 1916 C., 1917 C.E.
Jamestown, N. D.
Asst. Engr., N. P. Ry.

Weis, Wallace Dudley 1921 C.
Pontiac, Ill.
Foreman, Cameron Joyce Smith Elder Co.

Welin, Arthur G. 1912 C., 1913 C.E.
Address unknown; information requested.

Wellisch, Walton 1923 E.
887 Marshall Ave., St. Paul, Minn.
Secy., South Park Foundry & Mach. Co.

Wennerlund, Elias Carl 1899 M.
Address unknown; information requested.

Wentz, Walter W.
1914 E., 1916 E.E.
512 Delaware St. S. E., Minneapolis, Minn.
Instructor in Elec. Eng., Dunwoody Institute.

Werdenhoff, James Henric 1921 C.
Arkansas City, Kans.
Supt. of Mech. Instr., Roxana Petroleum Co.

Wesbrook, Donald McDermid
1910 M.
707 6th Ave. S. E., Minneapolis.
Dist. Mgr., Chicago Pneumatic Tool Co.

Wessale, George 1921 E.
Wacoma, Minn.
Asst. Supt., Sorghum Mills.

West, John C. 1915 C.
Tyler, Minn.

West, Robert William 1912 C.
Address unknown; information requested.

Westberg, Russell Elmar 1920 E.
4515 6th Ave. N. E., Seattle, Wash.
Asst. Engr., Westberg & Childs.

Weston, William Snow 1902 C.
Cheter., Wis.
Nurseryman and Landscape Gardener.

Wheeler, Herbert H. 1917 E.
40 Schermerhorn St., Brooklyn, N. Y.
Eng. Dept., Western Union Tel Co., New York City.

***Wheeler, Herbert Merrill** 1896 E.

White, Arden Dean 1922 C.
7385 Greenfield Ave., Detroit, Mich.
Asst. Engr., Chas. E. Knight, Civil Engr.

White, Charles W., 1912 E., 1913 E.E.
Address unknown; information requested.

Whitman, Edward A. 1900 C.
1659 W. Minnehaha Ave., St. Paul.
Gen. Supt., Washburn Lignite Coal Co.

Whitney, Alfred Carpenter 1903 G.
149 S. St. Albans St., St. Paul.
Pres., Schurmeier-Whitney Co.

Wichman, Martin F. 1922 E.
1320 Edgerton Ave., St. Paul, Minn.
Interference Engr., Northwestern Bell Tel. Co., Minneapolis.

Wicks, John 1904 E.
221 S. Kennilworth Ave., Oak Park, Ill.
Development Engr., Automatic Elec. Co., Chicago, Ill.

Widell, Gustaf Frederick 1908 C.
4421 N. Lincoln St., Chicago, Ill.
Lanquist & Illsley Co.

Wiesner, Frederick Edward 1906 C.
1608 1st Ave. N., Great Falls, Mont.
Office Engr., G. N. Ry.

Wiggins, Gerald Graham 1906 E.
Freneau, N. J.
Asst. Elec. Engr., Transit Commission, New York City.

Wiggins, John B. 1923 E.
2447 S. 56th St., Chicago, Ill.
Equip. Eng. Branch, Western Electric Co.

Wilcox, Halsey H. 1915 E.
3610 Lincoln Blvd., Omaha, Neb.
Dist. Equip. Supervision, Western Union Tel. Co.

Wilcox, Hugh Brown
1914 E., 1916 M.S.
100 Arthur Ave. S. E., Minneapolis.
Asst. Prof. of Mathematics and Mechanics, University of Minnesota.

Wilcox, Leslie William 1913 E.
2250 Princeton Ave., St. Paul, Minn.
Supt. of Elec. Distribution, St. Paul Gas Light Co.

Wild, Carl Daniel 1915 C., 1916 C.E.
Janesville, Ia.
Cashier, Bank of Janesville.

Wilk, Benjamin 1913 C., 1914 C.E.
1208 Montrose Ave., Chicago, Ill.
Asst. Western Mgr., Universal Portland Cement Co.

Willard, Arthur C. 1922 E.
903 Center St., Wilkensburgh, Pa.
Engr., Duquesne Light Co., Pittsburgh, Pa.

Williams, Arthur Howard 1919 M.
648 Newark Ave., Elizabeth, N. J.
Research Eng., Zeder Skelton Breer Eng. Co.

Williams, Charles Alfred 1916 C.
Address unknown; information requested.

Williams, Edward Hale 1903 M.
Pottstown, Pa.
Supt., S. G. Flagg Mfg. Co., Stowe, Pa.

Williams, Fred Mortimer
1905 B.A., 1909 E.
444 South 7th Ave., La Grange, Ill.
Tel. Engr., Western Electric Co.

Williams, Frederick J. 1917 E.
112 No. Smith St., St. Paul, Minn.
Designer, Commonwealth Elec. Co.

Williams, Myrl J. 1920 M.
6126 So. La Salle St., Chicago, Ill.
Asst. Supt. of Planning, Washburn Mfg. Co.

Williams, Percival Hamer 1922 E.
Technical Employee, American Tel. & Tel. Co., Minneapolis, Minn.

Williams, Roy N. 1923 E.
229 Liberty St., Schenectady, N. Y.
General Electric Co.

Williams, Wilbur S. 1909 M.
7441 Kingston Ave., Chicago, Ill.
Western Field Mgr., Laundryette Mfg. Co.

Willis, Benjamin Sutton 1917 E.
Washington, D. C.
Asst. Physicist, Bureau of Standards.

Willis, Roy 1908 C.
2124 Juliet St., St. Paul, Minn.
Asst. Engr., Dept. of Public Works.

Willner, William E. 1922 A.
3622 Chestnut St., Philadelphia, Pa.

Wills, Arthur Douglas 1921 A.
3132 Pleasant Ave., Minneapolis.
Draftsman and Designer, Long & Thorshov, Archts.

Wills, David C. 1923 E.
914 So. Austin Blvd., Oak Park, Ill.
Western Elec. Co., Chicago.

Willson, Manton Fletcher 1898 M.
Address unknown; information requested.

Wilson, Abner William 1923 E.
Devils Lake, N. D.
Mgr., Ramsey County Implement Co.

Wilson, Charles Albert 1922 C.
Tofte, Minn., care Engrs. Camp.
Draftsman, Minnesota Highway Dept.

Wilson, Eliel F. 1901 M., 1902 E.E.
Address unknown; information requested.

Wilson, Frank W. 1923 E.
730 Goodrich Ave., St. Paul, Minn.

Wilson, Glenn William 1911 E.
View St. No. 525, Mountain View, Cal.
Foreman, American Forge Co., San Farncisco, Cal.

Wilson, Paul Raymond 1921 E.
Omaha, Neb.
Engr., Northwestern Bell Tel. Co.

Wiltgen, Edward 1900 E.
Address unknown; information requested.

Withee, Warren 1915 C.
520 Pine St., Chattanooga, Tenn.
Asst. Engr., U. S. Geological Survey.

Woehler, William L. 1907 E.
3929 Portland Ave., Minneapolis.
Mgr., Elec. Dept., Harris Bros., Heating and Elec. Contrs.

Wolfangle, Raymond J. 1917 C.
532 Mendota St., St. Paul, Minn.
Design Engr., Minnesota Highway Dept.

Wolff, Henry E. 1912 C., 1913 C.E.
Address unknown; information requested.

Wolff, William Samuel
1915 M., 1916 M.E.
972 East 5th St., St. Paul, Minn.
Proprietor of Garage.

Wong, Jee Kwun 1916 M.
Address unknown; information requested.

Wood, John William 1905 E.
Address unknown; information requested.

Wood, Victor Russell 1922 C.
Two Harbors, Minn.
Resident Engr., Minnesota Highway Dept.

Woodman, Howard Howe 1897 C.
Pittsburg, Kan.
Coal Operator.

Woodman, Joseph Cushman 1911 M.
1937 Fremont Ave. S., Minneapolis.
Vice Pres., Stacy-Bates Co., Mftrs. Agts.

***Woodmansee, Charles Comstock**
1886 A.

Woodrich, Oscar Frederick 1908 C.
3734 Stevens Ave., Minneapolis, Minn.
Woodrich Constr. Co.

Woodward, Herbert Milton 1890 M.
12 Colonial Road, Boston, Mass.
Teacher of Mathematics, Mechanic Arts High School.

Wright, Harris H. 1909 M.
1214 East Gillham Road, Kansas City, Mo.
Mftrs. Agent, Heating Equipment.

Wright, Roydon Vincent 1898 M.
398 N. Walnut St., East Orange, N. J.
Secy., Simmons-Boardman Pub. Co., New York City.

Wright, Stewart Vern 1919 A.
1602 James St., St. Paul, Minn.
Draftsman, C. H. Johnston, State Archt.

***Wuest, Karl F.** 1914 E., 1915 E.E.

Wunderlich, Milton Sidney 1919 M., 1920 M.E.
1502 Selby Ave., St. Paul, Minn.
Flaxlinum Co.

Wyly, Lawrence T. 1920 G.
715 Univ. Ave. S. E., Minneapolis.
Struct. Draftsman, Bridge Dept., N. P. Ry., St. Paul.

Yager, Louis 1907 C.
940 Ashland Ave., St. Paul, Minn.
Asst. Chief Engr., N. P. Ry.

Young, Charles Nelson 1912 E.
7 Whittlesey Ave., West Orange, N. J.
Globe Indemnity Co., Newark, N. J.

Young, Joseph E. 1921 G.
481 North St., St. Paul, Minn.
City Architect's Office.

Zeleny, Frank 1898 M.
231 North Ave., Aurora, Ill.
Engr. of Tests, C. B. & Q. R. R.

Zimmer, William Arthur 1906 E.
Omaha, Neb.
Local Traffic Engr., Northwestern Bell Tel. Co.

Zimmerman, Arthur C. 1923 C.
202 Burke Bldg., Washington, D. C.
Deck Officer, U. S. Coast and Geodetic Survey.

Zimmerman, Louis Peter 1908 E.
Waseca, Minn.
Farming.

Zimmerschied, Clarence R. 1923 E.
3007 Grand Ave., Minneapolis, Minn.
Eng. Dept., Electric Mach. Co.

SCHOOL OF CHEMISTRY

Courses: Ch., Chemistry; Che., Chemical Engineering; AC, Analytical Chemist.

Advanced Degrees: Ch.E., Chemical Engineer; M.S. (Ch.), Master of Science in Chemistry; M.S. (Ch. E.), Master of Science in Chemical Engineering; Ph.D., Doctor of Philosophy.

* Deceased.

Alves, Eva Dresser 1909 Ch.
799 Faxon Ave., San Francisco, Cal.
Customs Chemist, U. S. Government Customs Laboratory.

Anderson, Edward X. 1908 Ch., 1909 M.S. (Ch.)
417 N. 6th St., Grand Forks, N. D.
Asst. Professor of Chemistry, University of North Dakota.

Anderson, Fredolf Theode 1913 Che., 1914 Ch.E.
Address unknown.

Anderson, M. M., 1920 Ch., 1921 Ch.E.
2120 Fairmont Ave. S. E., Minneapolis, Minn.
Manager, Minnesota Union, University of Minnesota.

Anderson, Winslow S. 1923 M.S. (Ch.)
State College Station, Raleigh, N. C.
Instructor in Chemistry, North Carolina State College.

Aronovsky, Samuel Isaac 1921 Che., 1922 Ch.E.
1008 Carlton Ave., Cloquet, Minn.
Asst. Chemical Engineer, Northwest Paper Co.

Bacon, Charles B. 1909 Ch.
Address unknown.

Badger, Walter Lucius 1908 Ch., 1909 M.S. (Ch.)
917 Church St., Ann Arbor, Mich.
Professor of Chemical Engineering, University of Michigan.

Baker, Russell E. 1911 Che.
191 Macalester Ave., St. Paul, Minn.
Secy., C. H. Young Co.

Bakke, Ole M. 1903 Ch.
5320 Willis Ave., Dallas, Texas.
Chief Chemist, Landon C. More.

Barnaby, William E. 1909 Che.
926 Selby Ave., St. Paul, Minn.
Automobile dealer.

Bakken, A. C. 1923 M.S. (Ch.)
New Kensington, Pa.
Research Chemist, Aluminum Company of America.

Barrett, Joseph O. 1922 Che., 1923 Ch.E.
1494 Capitol Ave., St. Paul, Minn.
Chemist, St. Paul Water Dept.

Beckel, Arthur C. 1919 Ch.
613 Oak St. S. E., Minneapolis.
Dupont Fellow, University of Minnesota.

Bell, Alexander Dewey 1916 Che., 1917 Ch.E.
1805 Portland Ave., St. Paul, Minn.
Vice-President and Chemist, Van Cleve Laboratories, Inc., Minneapolis.

Benner, Raymond C. 1902 Ch.
Long Island City, New York.
Research, Union Carbide Co.

Bernhagen, Lewis Otto 1906 AC.
Y. M. C. A., Beaumont, Texas.
Director of Sanitation, City of Beaumont.

Bicknell, Henry R. 1910 Ch.
20 East Acacia St., Stockton, Cal.
Chemist, Sperry Flour Co.

Bierman, Harry C. 1914 Ch., 1914 Ch.E.
Clover Club, Wilkinsburg, Pa.
Patent Attorney, Westinghouse Electric and Manufacturing Co., Pittsburgh.

Bolton, John B.* 1911 Che.

Boxell, Morris L. 1921 Che.
1815 Walnut St., Berkeley, Calif.
Research Chemist, Union Oil Company of California.

Borrowman, George L. 1905 AC.
9 S. Clinton St., Chicago, Ill.
Analytical and Consulting Chemist.

Bostwick, Ross D. 1923 Che.
Hollyard, Washington.

Brinton, Paul H. M.-P.
1912 Ch., 1913 M.S. (Ch.), 1916 Ph.D.
1112 6th St. S. E., Minneapolis, Minn.
Professor of Analytical Chemistry, University of Minnesota.

Brooks, Leslie C. 1919 Ch.
713 E. 15th St., Minneapolis, Minn.
Walsh Tie Co.

Bruce, G. Norman 1923 Che.
Address unknown.

Brunkow, Herbert E. C. 1912 Ch.E.
Delano, Minnesota.
Pickle manufacturer.

Burningham, F. A. 1917 Ch., 1918 Ch.E.
1118 Burns Ave., St. Paul, Minn.
Research Chemist, Brown Company, Berlin, New Hampshire.

Busch, John S. 1920 Ch., 1920 Ch.E.
Oconto Falls, Wisconsin.
Chemist, Falls Manufacturing Co.

Busch, William A. 1922 Che.
5005 Lyndale Ave. S., Minneapolis.

Callaway, R. S. 1911 Che.
4037 Abbott Ave. S., Minneapolis.
Purchasing Agent, University of Minnesota.

Cantwell, William F. 1911 Ch.
Littlefork, Minn.
Physician and Surgeon.

Cassel, Norman S. 1922 Che., 1923 Ch.E.
Cincinnati, Ohio.
Proctor and Gamble Co.

Chadbourne, L. Rodney 1922 Che., 1923 Ch.E.
Curtis Hotel, Minneapolis, Minn.

Chapin, Lewis Paul* 1897 Ch.E.

Corl, Cady S. 1921 Ch.
3029 Park Ave., Minneapolis, Minn.
Minnesota Dairy and Food Commission, St. Paul, Minn.

Cornell, Reuben W. 1921 Che., 1922 Ch.E.
Y. M. C. A., Red Wing, Minn.
Chemist, Pittsburgh Plate Glass Co.

Corson, Benjamin I. 1917 Ch.
2916 Constitution Road, Camden, N. J.
Chemist, R. M. Hollingshead Co.

Cressy, Charles R.* 1908 Ch.

Curtis, Faith (Sterling) 1909 Ch.
Banks, Oregon.
Science Teacher.

Dahlberg, Arnold V. 1905 Ch.
Newfolden, Minn.
Farming and working as Fieldman for Northern Sugar Corporation.

Dahlberg, Henry W. 1910 Che.
496 S. Washington St., Denver, Colo.
Manager of Research, Great Western Sugar Co.

Daniels, Elmer Anson 1912 Ch., 1913 M.S., 1917 Ph.D.
3546 Irving Ave., Berwyn, Ill.
Development Engineer, Western Electric Co., Chicago, Ill.

Daniels, Farrington 1910 Ch., M.S. 1911
Madison, Wisconsin.
Asst. Professor of Physical Chemistry, University of Wisconsin.

Darling, Stephen F. 1922 Ch.
613 Oak St. S.E., Minneapolis, Minn.
Assistant in Chemistry, University of Minnesota.

Davies, Edwin T. 1907 Che.
5057 Upton Ave. S., Minneapolis.
Chemist, City Engineer's Dept.

DeWitt, Joseph Henri 1910 Ch.
151 W. Summit Ave., St. Paul, Minn.
State Parole Agent, State Board of Parole.

Dietrichson, Gerhard 1910 Ch.
Urbana, Ill.
Instructor, University of Illinois.

Domovsky, Aaron 1917 Ch.
Address unknown.

Donauer, Max 1918 Che.
1000 19th St., Sioux City, Iowa.
Robb-Ross Company.

Doran, James M. 1907 Ch.
5520 13th St. N. W., Washington, D. C.
Chief, Industrial Alcohol and Chemical Division, Internal Revenue Bureau, Treasury Dept.

Dunnigan, Merton A. 1916 Ch.
1932 James Ave. S., Minneapolis.
Salesmanager, White Eagle Oil and Refining Co., St. Paul, Minn.

Durham, Samuel W. 1917 Ch.
2001 E. Slauson Ave., Los Angeles.
Woodard - Durham Manufacturing Co.

Eck, Lester J. 1923 Che.
700 Cromwell Ave., St. Paul, Minn.
Assistant in Chemistry, University of Minnesota.

Eckman, Lawrence R. 1917 Ch.
1305 E. 6th St., Tucson, Ariz.
Asst. Chemist, U. S. Bureau of Mines.

Edgar, Donald E. 1923 Che.
613 Oak St. S. E., Minneapolis, Minn.
Assistant in Chemistry, University of Minnesota.

Edwards, Junius David 1912 Ch., 1913 Ch.E.
536 6th St., Oakmont, Pa.
Assistant Director of Research, Aluminum Co. of America.

Egge, Walter* 1917 Ch.

Ellestad, Reuben B. 1922 Ch.
613 Oak St. S. E., Minneapolis, Minn.
Assistant in Chemistry, University of Minnesota.

Engstrom, Leslie G. 1919 Ch.
Address unknown.
Epstein, Hymen 1921 Ch.
2816 Wells St., Milwaukee, Wis.
Production Manager, Lavo Company of America.
Ernst, Robert C. 1923 M.S. (Che.)
500 Delaware St. S. E., Minneapolis.
Instructor, School of Chemistry, University of Minnesota.
Fegan, Elmer Thomas 1915 Ch.
Columbus, Ohio.
Chief Chemist, Fleischmann Yeast Co.
Felion, Arthur J. 1913 Ch.
4628 33d Ave. S., Minneapolis, Minn.
Asst. Chemist, Northern Pacific Ry., Como Shops, St. Paul, Minn.
Fieger, Ernest A. 1920 Ch., 1921 Ch.E.
425 Toronto Ave., St. Paul, Minn.
Graduate Student, Division of Soils, University Farm, St. Paul, Minn.
Firth, Charles V. 1923 Che.
613 Oak St. S. E., Minneapolis, Minn.
Asst. Chemical Engineer, Mines Experiment Station, University of Minnesota.
Fischer, Earl B. 1919 Ch.
1010 W. 43d St., Minneapolis, Minn.
Instructor, College of Pharmacy, University of Minnesota.
Frary, Francis C.
1905 AC., 1906 M.S., 1912 Ph.D.
1218 Hulton Road, Oakmont, Pa.
Director of Research, Aluminum Company of America, New Kensington, Pa.
Frederickson, Hubert M. 1923 Che.
Tulsa, Okla.
Junior Salesman, Empire Refineries, Inc.
Gauger, A. W. 1914 Ch.
709 Peralta Ave., Berkeley, Cal.
National Research Fellow in Chemistry, University of California.
Goldstein, Milton M.
1912 Ch., 1913 Ch.E.
4600 1st Ave. S., Minneapolis, Minn.
Architect and Builder.
Greenlaw, Charles E. 1919 Ch.
Address unknown.
Grout, Frank Fitch
1904 Ch., 1908 M.S. (Ch.)
504 University Ave. S. E., Minneapolis, Minn.
Prof. of Geology, University of Minnesota.
Gutsche, Edward J. 1904 Ch.
5869 W. Lafayette Blvd., Detroit, Mich.
Production Manager, Roberts Brass Manufacturing Co.
Gutsche, Frank Carl 1910 Che.
611 North Waiola Ave., LaGrange, Ill.
Chemist, Western Electric Company, Chicago, Ill.
Halvorson, Halvor Orin
1922 Che., 1923 Ch.E.
720 Huron St. S. E., Minneapolis.
Graduate Student, University of Minnesota.
Halvorson, Henry A. 1911 Ch.
452 N. Fairview St., St. Paul, Minn.
Chemist, Division of Feed Inspection.
Halverson, John Oliver 1907 Ch.
119 Ashe Ave., Raleigh, N. C.
In charge Food and Nutrition, State Dept. of Agriculture.
Hamilton, Herbert Clifton 1897 Ch.E.
160 Webb Ave., Detroit, Mich.
Chemist and Pharmacologist, Parke, Davis & Co.
Hammer, George Edward 1920 Ch.
331 11th St. N. E., Portland, Ore.
Salesman, Mutual Life Insurance Co. of New York.

Hammond, Kathryn D. 1922 Ch.
2556 Aldrich Ave. S., Minneapolis, Minn.
Education Student, University of Minnesota.
Harshaw, John Rippey 1912 Ch.
Address unknown.
Hartnett, John G. 1911 Ch.
Edgewood, Maryland.
Associate Chemist, Civil Service, Edgewood Arsenal.
Hatch, Lloyd 1923 Che.
Chf. Chem., Minn. Mining Co., St. Paul, Minn.
Hawkey, Harold Kimball
1919 Ch., 1919 Ch.E.
Address unknown.
Heck, Frank J. 1919 Ch.
418 Rice St., St. Paul, Minn.
Teaching Fellow, University of Minnesota.
Hennessy, Hugh J. 1911 Ch.
1864 Marshall Ave., St. Paul, Minn.
Chief Inspector, Division of Feed Inspection, Minn. Dairy and Food Dept.
Higburg, William 1917 Ch.
311 E. 46th St., Indianapolis, Ind.
Chemical Engineer, Republic Creosoting Co.
Hoff, John Edgar 1920 Ch.
5917 Worden St., Duluth, Minn.
Chemist, The Klearflax Linen Looms, Inc.
Hoffman, Henry Joseph 1913 Ch.
St. Paul, Minn.
Chemist, State Dairy and Food Dept.
Hogness, Thorfin Rusten
1918 Ch., 1919 Ch.E.
Berkeley, Calif.
Instructor, University of California.
Hopkins, Joseph Irwin 1904 Ch.
Address unknown.
Jackson, Myron Bangs 1905 AC.
Williston, North Dakota.
Treasurer, Credit Manager, Williston Grocery Co.
Johnson, Donald Lee
1918 Ch., 1920 Ch.E.
2357 Carter Ave., St. Paul, Minn.
Chemist, Washburn Crosby Co., Minneapolis, Minn.
Johnson, Einer 1911 Ch.
901 Selby Ave., St. Paul, Minn.
Chemist and Pharmacist, The La Salle Co.
Jones, Ernest Joseph
1920 Ch., 1921 Ch.E.
2430 College Ave., Berkeley, Calif.
Teaching Fellow in Chemistry, University of California.
Joselowitz, Goodwin 1918 Ch.
Minneapolis, Minn.
Chemist, City Health Dept.
Juvrud, Ingvald Oliver 1914 Ch.
722 E. 74th St. N., Portland, Ore.
Chief Chemist, Balfour, Guthrie & Co.
Kampa, Edmund 1923 Ch.
Tulsa, Okla.
Student, Doherty Training School, Empire Refineries, Inc.
Karatz, Lucian 1912 Ch.
Minneapolis, Minn.
Chemist, International Sugar Feed Co.
Katz-Nelson, William 1913 Ch.
Address unknown.
Kennedy, William W. 1907 Ch.
1866 Marshall Ave., St. Paul, Minn.
Manufacturer of Kennedy's Mayonnaise and Allied Products.
Kern, Herbert A.
1913 Ch., 1914 Ch.E.
1348 Howard St., Chicago, Ill.
Secy. and Gen'l Manager, Chicago Chemical Co.

Kessel, Herbert, 1918 Ch., 1919 Ch.E.
Los Angeles, Calif.
Credit Dept., Broadway Dept. Store.
Kesselman, Leo 1918 Ch.
Address unknown.
Kester, Ernest B. 1923 M.S. (Ch.)
904 Judson Ave., Evanston, Ill.
Public Health Institute Fellowship in Arsenic, Northwestern University.
Koch, Arthur Louis 1919 Ch.
1748 Wellesley Ave., St. Paul, Minn.
Superintendent, Twin City Brick Co.
Korfhage, Roy F. 1920 Ch.
320 Macalester Ave., St. Paul, Minn.
Analyst, Division of Feed Inspection.
Kracek, Frank C. 1920 Ch.
2951 Tilden St. N. W., Washington, D. C.
Physical Chemist at the Geophysical Laboratory, Carnegie Institute.
Kryger, Edward R. 1921 Ch.
931 Clark St., St. Paul, Minn.
Chemist, National Lead Battery Co.
Keuffner, Otto Karl 1909 Ch.
814 Fairmont Ave., St. Paul, Minn.
Kuentzel, Ward Edward 1917 Ch.
1471 Irving St. N. W., Washington, D. C.
Chemical Engineer, Fixed Nitrogen Research Laboratory, Dept. of Agriculture.
Lando, Maximillian Nandor 1902 Ch.
Address unknown.
Langseth, Axel O. 1922 Che.
1005 Jessie St., St. Paul, Minn.
Leavenworth, Francis Maury, 1911 Ch.
East Pittsburgh, Pa.
Research Dept., Westinghouse Electric and Manufacturing Co.
Lee, Melville Richard
1921 Che., 1922 Ch.E.
707 8th Ave. S. E., Minneapolis.
Cadet Engineer, Minnesota By-Product Coke Co.
Leerskov, Gerhard Wilhelm, 1921 Che.
4404 Curve Ave., Minneapolis, Minn.
Linton, James H. 1897 Ch.E.
2422 5th Ave. W., Seattle, Wash.
Proprietor of Pacific Coast Testing Laboratory.
Livermore, Harvey J. 1922 Che.
1704 Roblyn Ave., St. Paul, Minn.
Engineer, National Lead Battery Co.
Longworth, Fred James 1905 AC.
Address unknown.
Lowe, John M. 1908 Ch.
196 Park Ave., Leonia, N. J.
Midland Linseed Products Co., Manager, General Office, Minneapolis.
Luft, Oscar Wilhelm v.d. 1917 Ch.
239 Ridge Road, Boothwyn, Pa.
Chemical Engineer, National Aniline and Chemical Co., Marcus Hook, Pa.
Luger, Karl E. 1922 Che.
Aluminum Club, New Kensington, Pa.
Sales Apprentice, Aluminum Company of America.
McBride, Russell S. 1908 Ch.
20 Hesketh St., Chevy Chase, Washington, D. C.
Consulting Engineer, Chemist, Colorado Building.
McLeod, John Roderick* 1912 Ch.
McMillen, Elliott L. 1923 Che.
1830 Lincoln Ave., St. Paul, Minn.
Assistant in Chemistry, University of Minnesota.
McMiller, Paul Raymond 1911 Che.
726 11th Ave. S. E., Minneapolis.
Asst. Soils Chemist, Agricultural Experiment Station, University Farm.

Manuel, Douglas R. 1922 Che.
114 Orlin Ave. S. E., Minneapolis.
Republic Creosoting Co., St. Louis Park, Minn.

Manuel, Earle V. 1907 Ch.
Address unknown.

Markus, Benjamin 1917 Ch.
Hibbing, Minn.
Manager, Purity Ice Co.

Marr, Horace Sinclair 1917 Ch.
427 5th St., Niagara Falls, New York.
Research Engineer, American Magnesium Corporation.

Marshall, Olive Wadleigh 1917 Ch.
Henderson, Minnesota.
Science Instructor.

Martin, Edmund W. 1912 Ch.E.
927 Blackhawk St., Chicago, Ill.
Manager, Midland Linseed Products Co. (Crescent Works).

Mastin, Marion Gordon 1913 Ch.
Canajoharie, New York.
Chief Chemist, Beech-Nut Packing Co.

Matthews, Glenn Earl
1920 Ch., 1921 M.S.
107 Electric Ave., Rochester, New York.
Research Photographic Chemist, Eastman Kodak Co.

May, Darwin R., 1914 Ch., 1915 Ch.E.
213 Liberty Building, Indianapolis, Ind.
Chemical Engineer, Research Division, Republic Creosoting Co.

Merten, Howard Vincent 1914 Ch.
Jamshedpur, India.
Supt. of Blast Furnaces, Tata Iron and Steel Co.

Miller, Ralph Harrison 1913 Ch.
Address unknown.

Mitchell, Donald Francis
1920 Ch., 1921 Ch.E.
1000 W. Franklin Ave., Minneapolis.
Clerk, Pure Oil Co.

Mitchell, Ralph Wallace 1912 Ch.
1317 Second St., Menomonie, Wis.
Secretary, American Bakery Materials Co.

Morey, George W. 1909 Che.
2801 Upton St. N. W., Washington, D. C.
Physical Chemist, Geophysical Laboratory, Carnegie Institution.

Morin, William Truesdell
1922 Che., 1923 Ch.E.
San Francisco, Calif.
Technical Salesman, Pacific Abrasive Supply Co., 318 Mission St.

Morken, Carl H. 1922 Che.
3344 Columbus Ave., Minneapolis.
Chemist, 814 McKnight Building.

Morrow, Leon Walker 1916 Ch.
67 Hughes St., Quincy, 69, Mass.
Assistant Production Manager, National Leather Co., Boston.

Morse, Guilford A.
1915 Che., 1915 Ch.E.
Boise, Idaho.
Lumberman.

Neilson, Christ 1918 Ch.
Mankato, Minn.
Florist.

Nelson, Harry Godfrey 1918 Ch.
New Prague, Minn.
Chemist, International Milling Co.

Nesse, Charles Oscar 1912 Ch.
Address unknown.

Nicholson, Harry G.
1921 Che., 1922 Ch.E.
Crookston, Minn.
Concrete Inspector, Minnesota Highway Dept.

Nygaard, Edwin Marcus 1921 Ch.
3037 Fifth Ave. S., Minneapolis.
Asst. Chemist, Mines Experiment

O'Connell, Thomas Charles, 1913 Ch.
618 Walnut St., Donora, Pa.
Chemist, American Steel and Wire Co.

Olsen, Leslie Raymond 1915 Ch.
New Prague, Minn.
Chief Chemist, International Milling Co.

Olson, Arthur O. 1911 Ch.
3431 Tyler St. N. E., Minneapolis.
Analyst, State Dairy and Food Commission, St. Paul.

Otterstein, Earl Frank 1913 Ch.
2316 Aldrich Ave. S., Minneapolis.
Manager, Hospital Service Co.

Owens, Jay Clyde 1917 Ch.
12221 Harvard Ave., Chicago, Ill.
Chief Chemist, Sherwin Williams Co.

Pagel, H. Armin 1923 M.S.
Fergus Falls, Minn.
Instructor, Luther College.

Pan, Wen Ping 1918 Ch.
Hibbing, Minn.
Mining Engineer, Oliver Iron Mining Co.

Parkin, Guy George 1912 Ch.
2162 Stratford Ave., St. Paul, Minn.
Proprietor, Columbia Shop (phonographs).

Parrett, Arthur N.
1920 Ch., 1921 Ch.E.
305 Thaw Hall, University of Pittsburgh, Pittsburgh, Pa.
Instructor, University of Pittsburgh.

Paulson, Paul M. 1923 Che.
613 Oak St. S. E., Minneapolis, Minn.
Research Fellow, Engineering Experiment Station, University of Minn.

Pearson, Elmer A.
1920 Ch., 1921 Ch.E.
912 Garfield Place, Evanston, Ill.
Graduate Assistant in Chemistry, Northwestern University.

Pennock, Edward MacMaster
1905 AC.
2206 Doswell Ave., St. Paul, Minn.
Vice-President, G. H. Tennant Co., Minneapolis, Minn.

Peterson, Andrew Peter* 1910 Ch.

Peterson, Clifford E. 1923 Che.
2314 Herbert St., Milwaukee, Wis.
Chemist, Wm. O. Goodrich Linseed Oil Refineries.

Peterson, Henry, 1913 Ch., 1914 Ch.E.
Address unknown.

Peterson, Marshall A.
1921 Che., 1922 Ch.E.
1618 Charles St., St. Paul, Minn.
Chemist, Minnesota Highway Dept.

Pettijohn, Earl
1910 Ch., 1911 M.S., 1918 Ph.D.
1384 Grout St., Akron, Ohio.
Chief Chemist, Firestone Steel Products Co.

Pippel, Herbert August 1920 Ch.
Robbinsdale, Minn.

Poore, Charles Delos 1905 AC.
Glendale, Calif.

Porter, Allen Harold 1908 Ch.
266 Prospect Road, Mountain Lakes, New Jersey.
Flour Brokerage, Harry E. White, 89 Broad St., New York.

Porter, Ralph Elmer
1913 Ch., 1914 Ch.E.
234 Hampton St., Ashland, Ky.
Chief Chemist, Ashland Leather Co.

Rademacher, Richard L. 1923 Che.
2628 Harriet Ave., Minneapolis, Minn.
Graduate Student, University of Minnesota.

Ramsey, Selmer 1921 Che.

Rask, Olaf S. 1917 Ch.
Stanford University, Calif.
Research Fellow, Food Research Institute, Leland Stanford Univ.

Reck, Robert Carlyle
1921 Ch., 1921 Ch.E.
3029 Dupont Ave. S., Minneapolis.
Instructor in Drainage, Chemist for Drain Tile Investigation, University Farm.

Reu, Albrecht H., 1919 Ch., 1920 Ch.E.
Brunswick, Georgia.
Shift Supervisor, Hercules Powder Co.

Rice, Edgar Whitman 1902 Ch.
117 Radford St., Yonkers, New York.
Chemist, National Sugar Refining Co.

Riddington, Frederick W.
1921 Che., 1922 Ch.E.
1522 Highland Ave., Detroit, Mich.
Assistant Foreman in Plating Dept., Ainsworth Manufacturing Co.

Riley, Philip J. 1921 Ch.
119 Union St. S. E., Minneapolis.
Instructor, School of Chemistry, University of Minnesota.

Ringstrom, Hugo, 1915 Ch., 1917 M.S.
Appraiser's Bldg., San Francisco.
Junior Chemist, Internal Revenue Bureau.

Roberts, Wesley J.
1921 Che., 1922 Ch.E.
1425 Cedar St., Milwaukee, Wis.
Asst. Chemist, Patton-Pitcairn Division, Pittsburgh Plate Glass Co.

Robinson, Rhea Benedict 1912 Ch.
4237 Washburn Ave. S., Minneapolis, Minn.
Chief Chemist, Minneapolis Gas Light Co.

Rockwood, Ralph H. 1910 Ch.
210 Vernon Ave., St. Paul, Minn.
Chief Chemist, City of St. Paul.

Roehrich, Victor H.
1909 Che., 1910 M.S.
25 E. 5th St., St. Paul, Minn.
Director of Bureau of Municipal Testing Laboratories.

Rose, Anton Richard 1904 Ch.
Edgewater, New Jersey.
Professor of Chemistry, Fordham University.

Ruchhoft, Clarence 1921 Che.
Address unknown.

Schermer, Oscar C.
1921 Che., 1922 Ch.E.
628 8th Ave. S. E., Minneapolis.
Chemical Engineer, Manufacturers Chemical Co., Newport, Minn.

Schmidt, George Hermann 1912 Ch.
Address unknown.

Schwartz, Marcel 1922 Che.
Y. M. C. A. Hotel, Chicago, Ill.
Chemist, Commercial Testing and Engineering Co.

Selvig, Walter 1909 Ch.
4800 Forbes St., Pittsburgh, Pa.
Assistant Chemist, U. S. Bureau of Mines.

Seymour, Merrill Wilmer 1921 Ch.
Princeton, New Jersey.
Assistant in Chemistry, Princeton University.

Smith, Carolyn Harriet* 1910 Ch.

Smith, Sheldon Halloway 1910 Che.
994 Grand Ave., St. Paul, Minn.
Advertising Manager, Nicols, Dean and Gregg.

Sorenson, Ben Edmund 1923 Che.
613 Oak St. S. E., Minneapolis.
Assistant in Chemistry, University of Minnesota.

Souther, Benjamin L. 1916 Ch.
Address unknown.

Spriestersbach, David Oscar* 1912 Ch.

Sternberg, Heime A. 1920 Ch., 1921 Ch.E.
1714 Elliot Ave. S., Minneapolis, Minn.
Machine Operator, G. H. Tennant Co.

Stone, George H.* 1910 Ch.

Stone, Leslie F., 1922 Che., 1923 Ch.E.
613 Oak St. S. E., Minneapolis, Minn.
Assistant in Chemistry, University of Minnesota.

Stoppel, Arthur E. 1920 Ch., 1921 Ch.E.
613 Oak St. S. E., Minneapolis, Minn.
Assistant in Chemistry, University of Minnesota.

Stoppel, Ernest Albert 1911 Ch.
Address unknown.

Strong, Frank Dufresne 1917 Ch.
Headquarters, U. S. Marine Corps, Washington, D. C.
Captain, U. S. Marine Corps, W. S.

Sullivan, Betty 1922 Ch.
1014 17th Ave. N., Minneapolis, Minn.
Chemist, Russell Miller Milling Co.

Sutter, Hedwig Melanie
(Mrs. Roger Wilson) 1913 Ch.
2628 Humboldt Ave. S., Minneapolis, Minn.

Swart, Richard Houghton 1921 Ch.
2285½ Gordon Ave., St. Paul, Minn.
Ives Ice Cream Co.

Tappan, Ruth W. 1922 Ch.
Milwaukee Co. Hospital, Wauwatosa, Wis.
Technician.

Taylor, Carl A. 1910 Ch.
4800 Forbes St., Pittsburgh, Pa.
Explosives Chemist, U. S. Bureau of Mines.

Taylor, Cyril Stead 1913 Ch.
New Kensington, Pa.
Physical Chemist, Aluminum Co. of America.

Thordarson, William 1923 Che.
983 18th Ave. S. E., Minneapolis, Minn.
Graduate student, University of Minnesota.

Thorsen, Stuart John 1919 Ch.
University Hospital, Minneapolis, Minn.
Medical student, University of Minnesota.

Tibbling, Ernest F. 1914 Ch.
185 St. Anthony Ave., St. Paul, Minn.
Chemist, 98 W. Cook St.

Tinkham, Willis M. 1914 Ch.
3641 Colfax Ave. S., Minneapolis, Minn.
Chemist, Washburn-Crosby Co.

Toncheff, Stanil T. 1915 Ch.
Chemist, N. W. Elan Gas Co., St. Paul, Minn.

Tronson, Carl Fox 1910 Ch.
Rigby, Idaho.
Supt., Beet Growers Sugar Co.

Von Kuster, Edith
(Mrs. W. Johnson) 1907 Ch.
44 Adelaide Ave., New Brunswick, New Jersey.

Walker, George Warren 1909 Ch.
9601 American Ave., Detroit, Mich.
Chemist, Hupp Motor Car Corporation.

Wallfred, Carl Luther 1920 Ch., 1921 Ch.E.
4554 Wentworth Ave. S., Minneapolis, Minn.
Chemical Engineer, Mines Experiment Station, University of Minnesota.

Wanless, Lynn Allison 1912 Ch.
3101 E. 31st St., Minneapolis, Minn.

Washburn, Frederick M. 1917 Ch.
7267 Coles Ave., Chicago, Ill.
Chief Chemist, Coke Plant, Wisconsin Steel Co.

Webber, Frederick Walter, 1897 Ch.E.
2728 Humboldt Ave. S., Minneapolis, Minn.
Cashier, U. S. Customs.

Weber, Ludwig J. 1920 Ch., 1921 Ch.E.
2102 Fairmount Ave. S. E., Minneapolis, Minn.
Instructor, School of Mines, University of Minnesota.

Webster, Cora Helen 1923 Ch.
3008 Fremont Ave. S., Minneapolis, Minn.
Graduate student, University of Minnesota.

Westerberg, Carl George 1921 Ch.
1465 West 33rd St., Minneapolis, Minn.
Analyst, Northland Milk and Ice Cream Co.

White, Robert H. 1923 Che.
4316 Fremont Ave. S., Minneapolis, Minn.
Assistant in Chemistry, University of Minnesota.

Whited, Oric Ogilvie 1908 Ch.
4432 Dupont Ave. S., Minneapolis.
Realtor.

Widell, Gideon 1917 Ch.
28 Charles St., Bloomfield, New Jersey.
Chemical Engineer, Westinghouse Lamp Co.

Winslow, Raymond Martin 1919 Ch., 1920 Ch.E.
4609 Blaisdell Ave., Minneapolis, Minn.
Grice Associated Industrial Engineer.

Woolett, Guy Haines 1910 Ch., 1916 M.S., 1918 Ph.D.
University P. O., Mississippi.
Associate Professor of Chemistry, University of Mississippi.

Wyman, LeRoy Linwood 1922 Che., 1923 Ch.E.
Instructor, Oklahoma School of Mines.

Yngve, Victor 1913 Ch.
116 Appleton St., Cambridge, Mass.
Director Research, Manhattan Electrical Supply Co.

SCHOOL OF MINES

Abbott, Theodore S. 1911 E.M.
535 Grand Ave., St. Paul, Minn.
With Twin City Brick Co.

Adams, E. Maurice 1922 E. M.
Spring Grove, Minn.
Instrument man, Minnesota Highway Dept.

Ainsworth, Robert E. 1920 E.M.
Care H. V. Van Norman, Consulting Engr., 254 S. Broadway, Los Angeles, Calif.
Consulting Engineer for city of Los Angeles.

Allard, Raymond W. 1918 E.M.
2118 Marshall Ave., St. Paul, Minn.
Instructor, School of Mines, University of Minnesota.

Anderson, Alfred T. 1923 E.M.
Anaconda, Mont.
Research Testing Dept., Anaconda Copper Mining Co.

Anderson, Edwin H. 1917 E.M.
Crystal Falls, Mich.
Engr., McKinney Steel Co.

Anderson, Joseph H. 1911 E.M.
Information requested.

Anderson, Arthur P. 1914 E.M.
Information requested.

Anderson, Oscar B. 1922 E.M.
209 Washington St. N., Hibbing.
Engineering Dept., Oliver Iron Mining Co.

Anderson, Walter C. 1911 E.M.
Hibbing, Minn.
Engineer, Webb Mine, Shenango Furnace Co.

Angst, Harry H. 1905 E.M.
Chisholm, Minn.
Supt., Moroco Mine, Ironton, Minn.

Armstrong, Harold K. 1918 E.M.
3034 Lyndale Ave. S., Minneapolis.
Geologist, Cerro de Pasco Copper Corp., Cerro de Pasco, Peru.

Arnold, Lewis E. 1920 E.M.
2603 Stevens Ave., Minneapolis.
Junior mining engineer with the Braden Copper Co., Rancagua, Chile.

Aronson, Sam M. 1916 E.M.
Care Atlantic Oil Producing Co., Dallas, Tex.
Subsurface geologist, Atlantic Oil Producing Co.

Bailey, A. K., Jr. 1920 E.M.
Llallagua, Bolivia, S. A.
Chief Engineer with Compania Estanifera de Llallagua.

Bailey, Paul T. 1911 E.M.
Information requested.

Baker, Emory P. 1911 E.M.
6027 Woodlawn Ave., Chicago, Ill.
Chief draftsman, Bridge Dept., Illinois Central R. R. Co.

Baker, Clifton T. 1922 E.M.
Box 462, Newcastle, Pa.
Junior hydrauler Engr., U. S. Engineering Corps.

Barr, J. Carroll 1922 E.M.
509 N. Mercer St., Newcastle, Pa.
With Shenango Valley Improvement Co.

***Bass Samuel T.** 1904 E.M.

Bass, William C. 1899 E.M.
Information requested.

Bassett, Robert H. 1907 E.M.
Care of Hanna Ore Mining Co., Hibbing, Minn.
Chief Engineer, Hanna Ore Mining Co.

Beck, Charles S. 1911 E.M.
Box 504, Morenci, Ariz.
Supt., Morenci Water Co.

Becker, George 1897 E.M.
Information requested.

Bierman, Alfred C. 1914 E.M.
311 Southband Life Ins. Bldg., Dallas, Tex.
Engineer and geologist, Dallas, Tex.

***Bills, Eugene L.** 1910 E.M.

Bischoff, Harry R. 1910 E.M.
Box 354, Haileybury, Ont.
General mining work.

Bjorge, Guy N. 1912 E.M.
788 Mills Bldg., San Francisco, Cal.
Mining geologist.

Borgeson, Anshelm C. 1911 E.M.
Care Shenango Mine, Chisholm.
Washing plant tests, Webb's Washing Plant.

Bowman, Frank A. 1904 E.M.
Bellflower, Cal.
Mining Engineer.

Boyd, Robert R. 1905 E.M.
Box 576, Beverly Hills, Calif.
Mining Engineer.

Boyle, Patrick J. 1908 E.M.
Eveleth, Minn.
Garage proprietor.

Brackenbury, Cyril 1898 E.M., B.S.
St. Maur, Newton Abbot, Devonshire, Eng.
Joint Manager, Devon & Courtenay Clay Co.

Brandt, John 1906 E.M.
Hibbing, Minn.
With state of Minnesota, Dept. of Mines and Mineral Lands.

Brawley, John N. 1923 E.M.
829 Goodrich Ave., St. Paul, Minn.
With South Park Foundry & Machinery Co.

Brenner, Walter W. 1923 E.M.
Butte, Montana.
Black Rock Mine.

Brosius, Harold I. 1904 Met.
Minas de Oro, Honduras, C. A.
Examining mining properties in Honduras, C. A.

Buresch, Charles E. 1917 E.M.
Information requested.

Burgess, Robert J. 1911 E.M.
Yankee Hill, California.
Superintendent, Surcease Mine, Yankee Hill, Cal.

Burgess, Thomas O. 1901 E.M.
Porteau, B. C.
Superintendent, the Deeks Gravel & Rock Co.

Butler, Roy G. 1921 E.M.
233 Park Ave., Beaver Dam, Wis.
With Wisconsin Steel Co., at Nashwauk, Minn.

Butler, William V. 1915 E.M.
Forminiere, 66, Rue des Colonies, Brussels, Belgium.
Mining Engineer with Societe Internationale Forestiere et Miniere du Congo, Belgian Congo, Africa.

Cadwell, W. Chauncey 1905 E.M.
Box 143, Anaconda, Mont.
Supt., Surface Dept., Washoe Smelter, A. C. M. Co.

Calhoun, Allan B. 1905 E.M.
Burma, India.
Mine Manager, Burma Corporation, Ltd., Bawdwin, Burma, India.

Calhoun, Robert A. 1923 E.M.
Box 5, Dividend, Utah.
Sampling for Tintic Standard.

Callaway, Frederick W. 1900
Kellogg, Idaho.
Private Consulting Practice.

Campbell, William L. 1900 E.M.
Davenport, Wash.
Owner and operator, Farmers' Store, Davenport, Wash.

Carlson, Edwin N. 1921 E.M. (Geol.)
Box 1116, Wichita, Kan.
Geologist, White Eagle Oil and Refining Co., 900 Bitting Bldg.

***Cassilly, Thomas E.** 1917 E.M.

Chadbourn, Charles H. 1921 E.M.
Home address, 1912 Humboldt Ave. S., Minneapolis, Minn.

Chandler, Eugene D. 1900 E.M.
Casa Grande, Ariz.
Safety Engineer, Inspiration Consolidated Copper Co.

Chang Chen Ping 1922 E.M.
University of Wisconsin, Madison, Wis.
Post Graduate in Dept. of Geology, University of Wisconsin.

Chang, Chi 1923 E.M.
Arcana Hotel, Coleraine, Minn.
Engineer, Oliver Iron Mining Co.

Christenson, Alfred 1915 E.M.
Crystal Falls, Mich.
District Chief Engineer, The McKinney Steel Co.

Christianson, Peter
1890 B.X., 1898 E.M.
217 Union St. S. E., Minneapolis, Minn.
Professor of Metallurgy, School of Mines, University of Minnesota.

Clapp, W. Howard 1901 E.M.
Pasadena, Cal.
Professor of Mechanism and Machine Design, California Institute of

Clark, Fred E. 1920 E.M.
932 S. Main St., Los Angeles, Calif.
Los Angeles City Engineer's office.

***Clark, Malcolm W.** 1915

Clay, J. Withers 1923 E.M. (Geol.)
142 West 5th St., Atlanta, Ga.
Oil geologist.

Clement, Lester L. 1906 E.M.
928 Clark Ave., Ames, Ia.
District Engineer, Iowa Highway Commission.

Coady, Leo J. 1913 E.M.
Care North Butte Mining Co., Butte, Mont.
Efficiency Engineer, North Butte Mining Co.

Cohen, Julius M. 1912
Dominion Express Bldg., Montreal, Can.
Consulting and Examining Engr.

Cohen, Samuel W. 1903 E.M.
Dominion Express Bldg., Montreal, Can.
Consulting Mining Engineer, President and General Manager, General Asbestos Co., Ltd.

Cole, Willard A. 1909 E.M.
710 Security Bldg., Minneapolis.
District Engineer, E. J. Longyear Dev. Co., Inc., Birmingham, Ala.

Coller, W. A. 1915 E.M.
1149 Ashland Ave., St. Paul, Minn.
Brokers, Steel and Iron Products, St. Paul.

Collins, Leon T. 1915 E.M.
Information requested.

Conhaim, Howard J. 1923 E.M.
Care Lion Oil Refining Co., El Dorado, Ark.

Conkey, Charles R. 1910 E.M.
706 1st Ave. N., Minneapolis, Minn. Minn.
Asst. Gen. Mgr. and Dir., Fegles Constr. Co., Ltd.

Copeland, William A.
1920 E.M. (Geol.)
2591 West 7th St., St. Paul, Minn.
Instr. of Geology and Mineralogy, Carnegie Institute of Technology, Pittsburgh, Pa.

Coryell, Louis S. 1917 E.M. (Geol.)
Briston, Okla.
Consulting Geologist.

Coventry, Edward D. 1912 E.M.
Crosby, Minn.
Mining Engr., John A. Savage & Co.

Cowin, James 1907 E.M.
526 McKnight Bldg., Minneapolis, Minn.
Member of Salmon & Cowin, Mining Engrs. and Contrs.

Cowin, Percy G. 1918 E.M.
3826 Summit Ave., Birmingham, Ala.
Experimental Engr., Woodward Iron Co.

Craig, John J. 1916 E.M.
3817 1st Ave S., Minneapolis, Minn.
Asst Metallurgist, Mines Experiment Station, University of Minnesota.

Crouse, Charles S. 1911 E.M.
University of Kentucky, Dept. of Mines and Metallurgy, Lexington, Ky.
Cons. Oil Shale Technologist.

Crowley, Jay 1909 E.M.
Grafton, Cal.
Chief Engineer, Reclamation Districts, No. 1500 and 1660.

Cullyford, James A. 1908 E.M.
Box 56, Route 2, Lodi, Cal.
With Southern Pacific Co.

Curry, Duncan E. 1905 E.M.
122 Hart Ave., Ocean Park, Cal.
Foreman, Abe Lincoln Copper Co., Wickenburg, Ariz.

***Cutler, Harry C.** 1894 E.M.

***Dahl, Christen F.** 1908 E.M.

Davies, Fred A. 1916 E.M.
Box 1304, Billings, Mont.
Geologist, California Co.

Davies, Herman F., 1921 E.M. (Geol.)
Box 1304, Billings, Mont.
Geological work, California Co.

Dawson, Loren W. 1921 Met.
Darling, Minn., care N. P. Ry. Co.
With N. P. Ry., Maintenance and Constr. work.

Deichen, William A. 1908 E.M.
212 Mahoning St., Hibbing, Minn.
Asst. Chief Mining Engr. for the Tod-Stambaugh Co.

Dennis, Richard C. 1917 E.M.
Maracaibo, Venezuela, S. A.
Engr., New England Oil Corp.

De Vaney, Fred D. 1923 E.M.
216 E. Boyd, Dixon, Ill.
Awarded a research fellowship at the Southern Experimental Station of the University of Alabama at Tuscaloosa.

Devereux, Francis C. 1904 E.M.
Mina, Mexico.
Mill Supt., Mina, Mexico. Director, Sahuaripa, Sonora.

Devereux, Lawrence 1910 E.M.
1104 19th Ave. S. E., Minneapolis.
Draftsman for the Operation Dept. of filtration plant.

Dickson, Robert H. 1912 E.M.
Box 1435, Bixbee, Ariz.
Chief Engr., Calumen & Arizona Mining Co.

Dinmore, Harry C., Jr. 1923 E.M.
178 Fourth Ave., East Orange, N. J.
Inspector, Underwriters' Laboratories.

Donaghue, Abner J. 1920 E.M.
Box 65, Inspiration, Ariz.
Chief Mine Sampler, Inspiration Consolidated Copper Co.

Copp, J. Lawrence 1917 E.M.
Chiquacamata, Chile, S. A.
Engr., Chile Exploration Co.

Dovre, Adolph 1916 E.M.
Care Sun Oil Co., 4th Flr., American Exch. Nat. Bank, Dallas, Tex.
Production Dept., Sun Oil Co.

Dowdell, Ralph L.
1918 Met., 1922 M.S.
1466 Como Ave. W., St. Paul, Minn.
Instr. in Metallography, University of Minnesota.

Drake, George M. 1911 E.M.
834 First Nat.-Soo Line Bldg., Minneapolis, Minn.
Pres., Johnson, Drake & Piper, Gen. Contrs.

Duncan, Kenneth J. 1910 E.M.
Ely, Minn.
Supt., Zenith Mine for Vermilion Mining Co.

Echebarria, Luis de U. 1922 E.M.
420 Washington St. N., Hibbing, Minn.
Engr., Dean Iron Co.

Edwards, Frank R. 1908 E.M.
Information requested.

Edwin, John 1920 E.M.
2315 27th Ave. S., Minneapolis.
Mining Engr., M. A. Hanna Co., Hibbing, Minn.

Egleston, Oliver J. 1900 E.M.
Kennett, California.
Mgr., Mammoth Plants, U. S. Smelting, Refining & Mining Co.

Eidemiller, Howard N. 1914 E.M
Ramsay, Mich.
Chief Engr. and Geologist, Castile Mining Co.

Ekloff, Victor E. 1911 E.M.
Eureka, Utah.
Mining Engr., Chief Consolidated Mining Co.

Elliott, Jay R. 1911 E.M.
3312 3rd Ave. S., Minneapolis, Minn.
Pres. and Mgr., B. B. Specialty Co.

Elson, William H. 1917 E.M.
Petroleum Bldg., Tulsa, Okla.
With Riverland Oil Co. Also independent oil operator and consulting engineer.

Ely, Robert H. 1913 E.M.
Eveleth, Minn.
Mining Engr., Robinson-Flinn-Murphy-Door interests and Fowler Estate at Eveleth, Minn.

Erdmann, Charles E. 1923 E.M.
612 9th Ave. S. E., Minneapolis.
Post Graduate Work, University of Minnesota.

Erickson, Arthur C. 1923 E.M.
306 N. 5th Ave. W., Virginia, Minn.
Engr., Oliver Iron Mining Co.

Ernster, Omer F. 1917 E.M., M.S.
Care of Sinclair Exploration Co., Liberty Tower Bldg., New York, N. Y.
In charge of geological work in Angola Portuguese, West Africa.

Farnam, Henry E. 1910 E.M.
412 Builders Exchange, Duluth, Minn.
General contracting, Farnam Brothers Co., Duluth, Minn.

Fearing, Edward J. 1917 E.M.
Crosby, Minn.
Engr., John A. Savage & Co.

Field, Edward M. 1903 E.M.
804 Met. Life Bldg., Minneapolis, Minn.
With Mechanical Service Co.

Field, Thorold F. 1905 E.M.
Care of Mr. Chester A. Congdon Estate, 807 Lonsdale Bldg., Duluth.
In the employ of the Congdon Estate and general consulting engineering practice.

Fixen, Victor L. 1911 E.M.
506 Bldrs. Exchange Bldg., Duluth, Minn.
Engineer in charge of work, MacLeod Smith, Contrs.

Flynn, John G. 1903 E.M.
Information requested.

Foley, Lyndon L. 1918 E.M. (Geol.)
11 W. 48th St., Minneapolis, Minn.
Independent Geologist, Tulsa, Okla.

Fosness, Arthur W. 1913 E.M.
515 Union Bank Bldg., Winnipeg, Can.
Engr. for Carter-Halls-Aldinger Co.

Foss, Adolph L. 1923 E.M. (Geol.)
Box 476, Ramsay, Mich.
Asst. Mining Engr. and Geol., Castile Mining Co.

Frank, Elden 1921 E.M.
Home address, 319 N. 60th Ave. W., Duluth, Minn.
With Belgian-American Mining Co., Dundu, Angola.

Frank, Harry O. 1920 E.M.
2002 Lake of the Isles Blvd., Minneapolis, Minn.

Frellsen, Sidney A. 1919 E.M.
1523 E. Lake St., Minneapolis, Minn.
Cons. Engr.

Friedl, Arthur 1923 E.M. (Geol.)
1163 Laurel Ave., St. Paul, Minn.

Fritzberg, Ernest A. 1910 E.M.
Information requested.

Gallagher, Luke J. 1923 E.M.
Faribault, Minn.

Ganrud, Bennie W. 1921 E.M.
Rosiclare, Ill.
Chemist and Asst. Engr., Fairview Fluorspar & Lead Co.

Gannett, Roger W. 1918 E.M.
Mich. Ag. College, East Lansing, Mich.

Gavin, Lawrence T. 1909 E.M.
710 Providence Bldg., Duluth, Minn.
Vice Pres., Wm. H. Ziegler Co.

Gholz, Arthur L. 1901 E.M.
3005 James Ave. S., Minneapolis.
Mgr., Glide Road Machine Co., Minneapolis.

Gillan, Silas L. 1907 E.M.
203 W. Maple St., Glendale, Cal.
Mining Engr., 1021 Stock Exchange Bldg., Los Angeles, Cal.

Giltinan, George M. 1910 E.M.
Information requested.

Goldberg, Bert 1919 E.M.
Information requested.

Goldberg, Samuel B. 1919 E.M.
Quirivilca, Peru, via Trujillo, Peru.
Mine foreman and engineer for Quirivilca Mines of Northern Peru Mining and Smelting Co.

Goodrich, Norman P. 1910 E.M.
Gold Hill, Nev.
Asst. Mill Supt., United Comstock Mines Co.

Goodwin, William R. 1908 E.M.
2552 Aldrich Ave. S., Minneapolis.
Engineer of timber preservation, Soo Line Ry.

Gow, Alexander M. 1923 E.M.
1320 7th St. S. E., Minneapolis.
Technical Investigator, Mines Experiment Station, University of Minnesota.

Grant, Roy C. 1909 E.M.
66 Rue des Colonies, Bruxelles, Care of Forminiere.
Mining Egr., Compania de Diamantes de Angola and South West Africa Co., Ltd.

Grimes, John Alden 1908 E.M.
510 Treasury Annex No. 1, Washington, D. C.
Engineering Division, Income Tax Unit, Treasury Dept., U. S. A.

Griswold, Willis R., 1923 E.M. (Geol.)
509 N. Mercer St., Newcastle, Pa.
With Shenango Valley Improvement Co.

Gulick, Hervey 1905 E.M.
220 Markwell Bldg., Long Beach, Cal.
Civil Engineering, Los Angeles, Cal.

Gustafson, Arnold A. 1922 E.M.
Crosby, Minn.
Engr., Whitmarsh Mining Co. and fee agent for the Geo. H. Crosby interests, Crosby, Minn.

Hagstrom, Leonard J. 1912 E.M.
Home address, 4520 Xerxes Ave. S., Minneapolis, Minn.
Field Engr., Northern Appraisal Co.

Hale, William H. 1904 E.M.
607 5th Ave. S., Minneapolis, Minn.
Pres. and Treas., Wm. H. Hale & Co., Minneapolis.

Hamernik, Frank J. 1921 Met.
Kellogg, Idaho.
Asst. Chief Chemist, Bunker Hill Smelter.

Hammond, Arthur H. 1913 E.M.
Home address, 2015 Aldrich Ave. S., Minneapolis, Minn.
Chief Engr., Minas Pedrazzini Arizpe Son, Mex.

Hansen, Mayer G. 1922 E.M.
Box 210, Jerome, Ariz.
Geologist, United Verde Copper Co., Jerome, Ariz.

Hanson, J. Bernard 1913 E.M.
520 N. Dunlap, Memphis, Tenn.
Resident Engr. and Supt. for Gauger-Korsmo Constr. Co. at Memphis, Tenn.

Harmon, Benjamin 1910 E.M.
6 N. Michigan Ave., Chicago, Ill.

Harmon, Sydney E. 1917 E.M.
Henry L. Doherty & Co., 345 Hamm Bldg., St. Paul, Minn.
With Henry L. Doherty & Co.

Harrington, George L. 1912 E.M.
626 11th Ave. S. E., Minneapolis, Minn.
Geologist, Standard Oil Co. (N. J.) in Bolivia and Argentina.

Harrington, Guy P. 1906 E.M.
Box 709, Santa Fe, N. M.
Asst. Supervisor of Surveys, Dept. of the Interior.

Haugen, Albert C. 1915 E.M.
Hanska, Minn.
Surveys engineering work for different private parties.

Hawlick, Hartley H. 1923 E.M.
800 Flour Exchange, Crete, Neb.
With the Mill Mutual Ins. Co.

Heath, Clarence L. 1910 E.M.
Information requested.

Heidel, C. Sumner 1910 E.M.
Helena, Mont.
Chairman, Irrigation District Bond Commission.

Heilig, Louis S. 1915 E.M.
Apt. 102, 1918 Lyndale Ave. S., Minneapolis, Minn.
With Minnesota Tax Commission.

Henkel, Howard 1923 E.M. (Geol.)
Box 1866, Jerome, Ariz.
Miner and timberman.

Herring, William E. 1910 E.M.
Easton, Minn.

Hewitt, Ezra A. 1912 E.M.
Ray, Ariz.
Supt., Ray Hercules Mines, Inc., Ray, Ariz.

***Hill, A. Stanley** 1911 E.M.

Hoard, Harold J. 1903 E.M.
Care J. A. P. Crisfield Contracting Co., Box 122, Devon, Conn.
With the J. A. P. Crisfield Contracting Co. on steam plant construction.

Hoass, Ole G. 1908 E.M.
Care Federal Power Commission, Room 1215, Interior Bldg., Washington, D. C.
Mining Engr., Federal Power Commission, Washington, D. C.

Hoffman, Louis 1922 E.M.
830 Main St., Peoria, Ill.
Highway Engr., State of Illinois.

Hognason, George B. 1909 E.M.
Information requested.

Holden, Henry H. 1903 Met.
4027 Goldfinch St., San Diego, Cal.
Cons. Engr.

Holler, Frederick W. 1910 E.M.
La Salle, Ill.
Gen. Mgr., Mathiessen & Hegeler Zinc Co.

Hondrum, Olaf 1913 E.M.
Jerome, Ariz.
Shift Box, United Verde Copper Co.

Hope, Lawrence I. 1922 E.M.
City engineer's office, Minneapolis, Minn.
Junior Engr., Minneapolis City Engineer's Office.

Hosted, Joseph Orrin 1919 E.M. (Geol.)
Lead, S. D.
Geologist, Homestake Mining Co.

Houlton, Lewis K. 1904 E.M.
Elk River, Minn.
Pres., First National Bank, Elk River, Minn.

Howes, Frank T. 1906 E.M.
1472 Ashland Ave., St. Paul, Minn.
Asst. Engr., Northern Pacific Ry.

Hoyt, Samuel L. 1909 E.M., Ph.D.
Nela Park, Cleveland, Ohio.
War work, consulting metallurgist of the U. S. Bureau of Mines in co-operation with National Research Council for the war minerals investigation.

Hsieh, Chung 1918 E.M.
Care Kirin Y. M. C. A., Kirin City, China.
With Andersen Meyer & Co., at Mukden as engineering salesman.

Hubbard, William E. 1917 E.M. (Geol.)
Drawer 58, Ardmore, Okla.
Division geologist, Humble Oil and Refining Co., Cisco, Tex.

***Hughes, Thomas M.** 1896 E.M.

Hunt, Walter E. 1900 E.M.
411 Fairview Ave., Glendale, Cal.
Mining Engr., E. J. Longyear Co.

***Hurley, John J.** 1911 E.M.

Ingersoll, Guy E. 1918 E.M. (Geol.)
Ray, Ariz.
Shift boss, Ray Consolidated Copper Co.

Jackson, Charles F. 1907 E.M.
Skouriotissa, Nicosia, Cypress.
With Cyprus Mines Corporation.

***Jacobson, Harry** 1910 E.M.

Jahn, William F. 1911 E.M.
3036 Bryant Ave. S., Minneapolis.
Sahuaripa, Sonora, Mexico.

Jeffers, Gordon B. 1923 E.M.
College of Mines, University of Washington, Seattle, Wash.

Jerrard, W. L. 1918 E.M.
South Hibbing, Minn.
Owner, Security Service Garage.

Johnsen, Trygve 1923 Met.
Eng. Dept., N. P. Ry., St. Paul.
Insptr. of Const., N. P. Ry. Co.

Johnson, Algot F. 1910 E.M.
912 Plymouth Bldg., Minneapolis.
Senior member of Johnson, Drake & Piper, Inc., Gen. Contrs.

Johnson, Axel L. 1920 E.M.
Box 412, Nashwauk, Minn.
Engr., Butler Bros. Mines, Cooley, Minn.

Johnson, Ralph C. 1922 E.M.
706 Sherburne Ave., St. Paul, Minn.
Sec.-Treas., Independent Oil Co., Elk River, Minn.

***Johnson, Ralph I.** 1903 E.M.

Johnston, Kenneth A. 1921 E.M.
1457 Capitol Ave., St. Paul, Minn.
Engr., Minnewas Mine, Oliver Iron Mining Co., Virginia, Minn.

Jones, Philo E. 1910 E.M.
509 Oak St., Kelso, Wash.
Member Consolidated Construction Co., Kelso, Wash.

Keene, Amor F. 1904 E.M.
42 Broadway, New York City.
Cons. Mining Engr.

Kegler, Vern L. 1923 E.M. (Geol.)
Isabelle, Tenn.
Res. Engr., Ducktown Sulphur, Copper & Iron Co., Ltd.

Keller, Orrin 1905 E.M.
1621 Kincaid St., Highland Park, Ill.
Pres., Arcady Farms Milling Co., Chicago.

Kennedy, John J. 1908 E.M.
14th Floor, 11 Broadway, New York.
Export Mgr., Ingersoll-Rand Co.

Kerr, Charles D. 1915 E.M.
101 Leonidas Location, Eveleth, Minn.
Oliver Iron Mining Co.

Kersten, Erwin H. 1920 E.M.
School of Mines, Univ. of Minn., Minneapolis, Minn.
Instr., Dept. of Met.

Kilp, Raymond G. 1922 E.M.

Kingsley, Neil S. 1911 E.M.
3009 Portland Ave., Minneapolis.
With Standard Oil Co.

Kingston, Merton S. 1904 E.M.
Eveleth, Minn.
Operating Kingston Mining Co., Rutland Mining Co., Fault Mining Co.

Knickerbocker, Arthur K., 1908 E.M.
Box 493, Virginia, Minn.
Mining Engr., Stanley Mining Co.

Knox, LaFayette 1912 E.M.
Hurley, N. M.
Chief Engr., Chino Copper Co., Hurley Plant.

Kremer, Edward G. 1912 E.M.
5024 Harriet Ave., Minneapolis.
Kremer & Hog, Excavating & Gen. Contrs., 1727 La Salle Ave.

Krogh, Avin T. 1916 Met.
3221 E. 24th St., Minneapolis, Minn.
Research Engr., Research Dept., Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

Kurtzman, Paul S. 1905 E.M.
Box 627, Hibbing, Minn.
Supt., Albany Mine, Pickands, Mather & Co.

Kwong, Shou Kun 1923 E.M.
Apt. 3B, 500 122nd St. W., New York City.
Postgraduate work, Columbia Univ.

Kwong, Yih Kun 1917 E.M. (Geol.)
Care K. W. Kwong, Kiangnan Dock & Eng. Works, Shanghai, China.
With Kiangnan Dock & Eng. Wks.

Ladd, Greeley 1913 E.M.
2404 Russell Ave. S., Minneapolis.
Asst. Secy.-Treas., Lavoris Chemical Co.

Larson, Clarence L. 1910 E.M.
437 North "O" St., Muskogee, Okla.
Pres., Hex Southern Mills Lbr. Co.

Larson, Ernest L. 1914 E.M.
Linnton, Ore.
Operating orchard; also with B. L. Lbr. Co.

LaTendresse, Henri E. 1923 E.M. (Geol.)
Care Midwest Refining Co., Denver, Colo.

Lea, John 1912 E.M.
Moopa, Neb.
Supt., White Star Plaster Co.

***Lee, Laing** 1918 Met.

Lee, Oscar 1916 E.M.
U. S. Bureau of Mines, Tuscaloosa, Ala.
U. S. Bureau of Mines.

Leonard, F. Morton 1910 E.M.
United States Tariff Commission, Washington, D. C.
Special Expert, United States Tariff Commission.

Levorsen, A. Irving 1917 E.M.
1335 East Eight St., Okmulgee, Okla.
Dist. Geol., Gypsy Oil Co.

Levy, Julian H. 1924 E.M.
Springfield, Ill.
Testing Dept., Illinois State Highway Commission.

Lewis, I. Whitney 1912 E.M.
623 Mid. Continent Bldg., Tulsa, Okla.
Consulting geologist and oil producer, Tulsa, Okla.

Lilly, Richard I. 1923 E.M. (Geol.)
233 Grotto St., St. Paul, Minn.
Instr. in Geology, Williams College, Williamstown, Mass.

Lin, Sze Chen 1922 E.M.
36 San Sieh Chie, West City, Peking, China.

Lindholm, Milton S. 1911 E.M.
Ortonville, Minn.
With C. & A. Mining Co., Bisbee

Locke, Alfred M. 1908 E.M.
Waterloo, Iowa.
Research Engr.

Lovering, Thomas S. 1923 E.M. (Geol.) M.S.
Dept. of Geol. U. of M., Minneapolis
Instr. Dept. of Geol. Univ. of Minn.

Love, Henry E. 1905 E.M.
Hibbing, Minn.
Asst. Chief Engr., Hibbing District.

Lundquist, O. William 1923 E.M.
Babbitt, Minn.
Outside Engr., Mesaba Iron Co.

Lytzen, Walter W. 1905 E.M.
Prescott, Ariz.
Private Practice, Prescott, Ariz.

McAdama, Howard R. 1912 E.M.
Eveleth, Minn.
Oliver Iron Mining Co.

McCarty, Andrew L. 1904 E.M.
Information requested.

McCarty, Edward Prosper 1900 E.M.
Laramie, Wyo.
Prof. of Mining Eng., Univ. of Wyo.

***McCreery, A. S.** 1907 E.M.

McCullough, Ervin W. 1911 E.M. Met.
214 Liberty Bldg., Indianapolis, Ind.
Director, Division of Mining and Metallurgy, Republic Creosoting Co.

McDermid, Archie J. 1916 E.M.
Quartzburg, Idaho.
General underground labor on various western mines.

McHardy, Roy H. 1898 E.M.
Information requested.

McIntosh, Joseph B. 1898 E.M.
1108 Mills Bldg., El Paso, Tex.
Engr., American Smelting & Refining Co.

McKay, Henry S. 1905 E.M.
Cananea, Sonora, Mex.

McKenzie, Frederick R. 1922 E.M.
1910 4th St. S. E., Minneapolis.

McKenzie, James R. 1910 E.M.
MacDonald Eng. Co., Chicago, Ill.
Supt. on construction MacDonald Eng. Co.

McRae, Randolph J. 1907 E.M.
Information requested.

***Malcolmson, George E.** 1907 E.M.

Mark, Israel C. 1920 E.M.
(Home address) 828 16th Ave. N., Minneapolis, Minn.

Martin, Lynn 1912 E.M.
Glenwood, Minn.
Firm, Martin & Johnson.

May, Albert E. 1894 B.A., 1898 E.M.
10 Beals St., Brookline, Mass.
Manager Guadalupe Consolidated Mining Co., Indi Durango, Mex.

Mellem, Walter R. 1919 E.M.
Crosby, Minn.
Coach and science instructor, Crosby-Ironton High School.

Merriam, Robert S. 1905 E.M.
Wallace, Idaho.
Chief Engr., Callahan Zinc-Lead Co.

Merritt, Lucien 1904 E.M.
428 Met. Bank Bldg., Minneapolis.
Contractor.

Michie, Roy G. 1913 E.M.
(Permanent address) Montevideo, Minn.
County engineer.

Middleton, John L. 1923 E.M. (Geol.)
Forminiere, Mission Butler, Amadi, Congo Belge.
Prospecting.

Mills, Eugene C. 1897 E.M.
Sacramento, Cal.
Consulting engineer, irrigation and drainage.

Minder, E. G. 1905 E.M.
Slayton, Minn.
Consulting engr. at Slayton, Minn.

Moenke, William F. 1906 E.M.
Box 69, Sunrise, Wyo.

Moga, Gregory M. 1922 E.M.
1115 E. 1st St., Duluth, Minn.
Foreman Western Tool & Forge Co.

Moga, John A. 1918 E.M.
271 Charles St., St. Paul, Minn.
Stdt., Medical School, U. of Minn.

Moody, Revillo G. 1910 E.M.
3439 10th Ave. S., Minneapolis.
Eng. Dept., City of Minneapolis

Mooney, Frank E. 1923 Met.
635 Harrison St., Gary, Ind.
Illinois Steel Co., Gary plant.

Morgan, Charles 1906 E.M.
2019 Clarendon Ave., Bessemer, Ala.
Supt. Brown Ore Mine, Woodwald Iron Co., Woodstock, Ala.

***Morris, Charles S.** 1902 E.M.

Neerland, Herman 1915 E.M.
1246 Univ. Ave., St. Paul, Minn.
Right-of-way engineer, Minnesota Highway Dept.

Neustadt, Bertholdt R. 1906 E.M.
Information requested.

Newell, John R. 1910 E.M.
Box 1033, Spokane, Wash.
Mgr., Spokane Concrete Pipe Co.

Nicholls, William J. 1921 Met.
International, Utah.
Assayer, International Smelter.

Nichols, Clifford R. 1920 E.M.
Plymouth, Cal.
Engr., E. L. Longyear Dev. Co.

Nissen, Arvid E. 1913 E.M.M.S.
Edgewood Arsenal Md. Bldg. 86.
Physicist, Chemical Warfare Service, Edgewood Arsenal, Md.

***Noehl, Bartley F.** 1907 E.M.

Nord, Harry H. 1916 E.M.
Billings Mine, Chisholm, Minn.
Mine captain, Billings Mine, Stambaugh Iron Co., Chisholm.

Oberg, Anton C. 1907 E.M.
316 Sellwood Bldg., Duluth, Minn.
Consulting mining engineer, Duluth, Minn.

O'Brien, J. Charles 1912 E.M.
A. C. M. Co., Conda, Idaho.
Foreman, A. C. M. Phosphate Mine, Conda, Idaho.

O'Connor, Edward S. 1906 E.M.
P. O. Box 696, Mayville, Wis.
Mine Supt., The Mayville Iron Co.

Ofsthun, Norman H. 1913 E.M.
Information requested.

Olmstead, John S. 1908 E.M.
Information requested.

Olson, Walter S. 1912 E.M.
306 Williams St., St. Paul, Minn.
Commission of Drainage and Waters. Office engineer, Old Capitol Bldg.

Olund, Henning E. 1907 E.M.
Information requested.

Ofstrand, Peter M. 1910 E.M.
Information requested.

Pabst, Henry A. 1923 E.M.
Hibbing, Minn.
Pit engineer at Mahoning Mine, Pickands, Mather & Co.

Pan, Wen Ping 1919 Met.
Hibbing, Minn.
Mining Engr., Oliver Iron Mining Co.

Parker, Walter H. 1907 E.M.
School of Mines, University of Minnesota, Minneapolis, Minn.
Associate professor of mining.

Patten, Richard C. 1922 E.. (Geol.)
Information requested.

Perry, Joseph B. 1912 E.M.
Porterville, Cal.
Supt. of Mines, Sierra Magnesite Co.

Persons, Robert Wayne 1923 Met.
Ingersoll-Rand Co., 11 Broadway, New York City.
Sales Engineer, Rock Drill Sales

Peterson, Andrew Y. 1899 E.M.
Coleraine, Minn.
Gen. Supt., Canisteo Dist., Oliver Iron Mining Co.

Peterson, Clarence D. 1920 E.M.
1927 Washington Ave. S., Minneapolis, Minn.
Field Engr., Bureau of Buildings, Board of Education.

Peterson, Joseph S. 1908 E.M.
Smuggler, Colo.
Asst. gen. mgr., Tomboy G. M. Co., Telluride, Colo.

Peterson, Paul A. 1917 Met.
Information requested.

Plut, Frank J. 1922 E.M.
P. O. Box 484, Ironton, Minn.
Engr., Whitmarsh Mining Co., Ironton.

Potter, Orrin W. 1914 E.M.
1803 Princeton Ave., St. Paul.
Instr. in drawing and descriptive geometry, Univ. of Minn.

***Pratt, George A.** 1898 E.M.

Probst, Elmer A. 1907 E.M.
Amalfi, Colombia, S. A.
Mgr. LaViborita Co., Amalfi, Colombia, S. A.

Prouty, Roswell W. 1912 E.M.
Riverside, California.
Examining engr., Riverside Portland Cement, Riverside, Cal.

Queneau, Roland B. 1923 Met.
179 Congress Ave., Providence, R. I.
Asst. engr. to Pitometer Co., 50 Church St., N. Y. C.

Quinlan, Howard 1914 E.M.
542 Ashland Ave., St. Paul, Minn.
With Allen Quinlan Co., vice pres.

Quinn, Howard E. 1918 E.M. (Geol.)
Melrose, Minn.

Quinn, Max F. 1902 E.M.
Sierra Mojada, Mexico.
Asst. supt., A. S. & R. Co.

Rahilly, Harold J. 1911 E.M.
care of Anaconda Copper Mining Co., Butte, Mont.
Mine supt., Tramway Mine, Anaconda Copper Mining Co.

Rait, Donald M. 1903 E.M.
Box 744, Warren, Ariz.
Engr., Calumet and Arizona Mining Co.

Raiter, Clifford R. 1920 E.M.
1303 Sherbourne Ave., St. Paul.
Asst. Supt. construction and repairs, City of St. Paul.

Ramsing, Fred C. 1915 E.M.
125½ Elm St., Anaconda, Mont.
Chemist, Research Lab., Anaconda Copper Mining Co. Also consulting engineer for Ideal Mining Co.

Ravicz, Louis G. 1914 E.M.
Hayden, Stone & Co., 25 Broad St., New York, N. Y.
Petroleum geologist and engineer, Hayden, Stone & Co.

Rawson, Horace C. 1906 E.M.
2015 W. 49th St., Minneapolis.
Building Construction, Minneapolis.

Ridgway, Robert H. 1923 E.M.
1905 Stevens Ave., Minneapolis.
Technical investigator, Mines Experimental Station, U. of M.

Robertson, John H. 1914 E.M.
Information requested.

Roed, Olaf A. 1907 E.M.
Information requested.

Tood, Lynn 1909 E.M.
care of Chas. Weinhagen & Co., St. Paul, Minn.
Sec.-treas., Chas. Weinhagen & Co.

Rose, William A. 1906 E.M.
Duluth, Minn.
Asst. gen. mgr., Pickands, Mather

Russell, Charles B. 1923 E.M.
Reedsville, W. Va.
Min. engr., Bethlehem Mines, Corp.

Sanchez, Richard M. 1915 E.M.
Casapalca, Peru, S. A.
Chief engr., Sociedad Minera Backus y Johnston del Peru.

Sanderson, Henry S. 1901 Met.
406 Interstate Bldg., Denver, Colo.
Consulting mining engineer and U. S. Mineral Surveyor.

Sqnto, Julius H. 1909 E.M.
Ely, Minn.
Dean of Junior College.

Scheid, Adolph J. 1923 Met.
137 Sycamore St., Milwaukee, Wis.
With Columbia Tool Steel Co.

Schrader, Erich J. 1905 E.M.
Reno, Nev., and 2201 Princeton Ave., St. Paul, Minn.
Consulting work.

Searles, John 1923 E.M.
State Highway Dept., Wabasha, Minn.
With Minn. State Highway Dept.

Sebenius, Carl H. 1921 E.M.
Mexico, Ky.
Lafayette Fluorspar Co., Mexico, Ky.

Shonts, Sydney L. 1904 E.M.
Wallace, Idaho.
Consulting Mining Engr.

Sjolinder, Anthony O. 1923 E.M.
1917 Feronia Ave., St. Paul, Minn.
Const. Div. of Eng. Dept., N. P. R. R.

Smith, C. James 1902 E.M.
Box 298, Coronado, Cal.
Cons. Engr. and Geol.

Smith, Edgar W. 1907 E.M.
3520 W. Lake Calhoun Blvd., Minneapolis, Minn.
Engr. associated with Carl A. Gage, Architect, and others.

Smith, Elmo V. 1901 Met.
1610 Walker Bank Bldg., Salt Lake City, Utah.
Contr. Mgr., American Bridge Co.

Smith, Franklin W. 1903 E.M.
Member of the firm of Smith & Ziesemer, Bisbee, Ariz.

Smith, Hoval A. 1901 E.M.
Care F. F. Reed, 841 Peoples Gas Bldg., Chicago, Ill.
Mining Engr.

Sowle, Lawrence K. 1903 E.M.
202 Marshall Bldg., Cleveland, O.
Real estate and mortgage securities.

Sponberg, E. Clarence 1921 E.M.
Berkshire Mine, Mellen, Wis.
Asst. and Chem. Engr., Berkshire Mining & Development Co.

***Squyer, Dewey C.** 1904 E.M.

Steele, Charles W. 1907 E.M.
Electric Steel Foundry, Portland, Ore.
Sales Engr., Electric Steel Foundry.

Stevens, Howard E. 1912 E.M.
203 W. Howard St., Hibbing, Minn.
Constr. Foreman, Belanger & Lundberg Co.

Stewart, G. Gordon 1910 E.M.
Roseburg, Ore.
Private engineering practice and U. S. mineral surveyor.

Strand, Harry W. 1908 E.M.
Mellen, Wis.
Supt., Berkshire Mine.

Strane, Archie J. 1910 E.M.
1140 Dayton Ave., St. Paul, Minn.
Special representative of White Eagle Oil & Refining Co., Midway, St. Paul, Minn.

Strong, John L. 1908 E.M.
615 Wolvin Bldg., Duluth, Minn.
Mining Engr., Oliver Mining Co.

Swanson, Alex H. 1910 E.M.
Information requested.

***Swartz, Sam G.** 1911 E.M.

Sweetman, Edwin A. 1917 E.M. (Geol.)
Virginia, Minn.
Mining Engr., Interstate Iron Co.

Swensen, Clifford H. 1923 E.M.
Bethlehem Mines Corp., Bethlehem, Pa.
Constr. Engr., Preston Division.

Swensen, Karl P. 1907 E.M., B.S.
51 Chambers St., New York, N. Y.
Oriental Mgr., Allied Machinery Co. of America, New York, N. Y.

Tanner, Wallace N. 1896 E.M.
520 Hennessy Bldg., Butte, Mont.
Chief Mechanical Engr., Anaconda Copper Mining Co.

Taresh, John 1901 E.M.
Rio Oso, Cal.
Engr. and Secy., Reclamation District No. 1001.

Taylor, Harold G. 1909 E.M.
1046 McKnight Bldg., Minneapolis.
Northwestern Sales Engr., Permutit Co.

Taylor, William L. 1912 E.M.
Verona, Mich.
Supt., Plymouth Mining Co.

Teague, Harold W.
Information requested.

Tetlie, John R. 1911 E.M.
Comstock, Nev.
Chemist, United Comstock Mines Co., Gold Hill, Nev.

Thellin, Herbert E. 1923 E.M.
Box 333, Crosby, Minn.
Asst. City Engr.

Thoeni, Victor T. 1922 E.M.
519 McKinley Ave., Kellogg, Idaho.
Assayer, Assay Office, Bunker Hill and Sullivan Smelter.

Toll, Rensselaer 1900 E.M.
477 Monadnock Bldg., San Francisco, Cal.

Tollefson, Everett H. 1923 E.M.
2739 Girard Ave. S., Minneapolis.
Instr., Dept. of Drawing, U. of M.

Truesdale, W. H. 1903 E.M., M.S.
Information requested.

Urquhart, George K. 1915 E.M.
Elcor, Minn.
Engr., Elba and Corsica Mines, Pickands, Mather & Co.

***Victor, Albin F.** 1912 E.M.

Vivian, Edgar W. 1923 E.M.
Utica Mine, Hibbing, Minn.
Engr., Utica Mine, Hibbing, Minn.

Wade, Henry H. 1915 E.M.
Hopkins, Minn.
Metallurgist, School of Mines Experiment Station, Univ. of Minn.

Wales, Roqland T. 1897 E.M.
57 Morris St., New Rochelle, N. Y.
Owner of patents for concrete forms, owned and erected by the Liomin & Wales Co., Inc., of N.Y.C.

Walker, Charles A. 1913 E.M.
Information requested.

Walker, Clinton L. 1898 E.M.
650 Highland Ave., Piedmont, Oakland, Cal.
Captain, Engineering, U. S. R.

Walker, E. H. 1911 E.M.
Elizabethville, Katanga, Congo-Belge, Africa.
Mine Mgr., Union Hiniera Du Haut-Katanga.

Wallace, Carleton S. 1917 E.M. (Geol.)
2003 Queen Ave. S., Minneapolis.
Tile Contr., Hollywood, Cal.

Wallace, George W. 1906 E.M.

Wallinder, Arthur 1912 E.M.
Iron Mask Mine, Kamloops, B. C.
Supt. and Gen. Mgr., Kamloops Copper Co.

Walter, Rollie B. 1912 E.M.
Salt Creek, Wyo.
Petroleum engineering student in the field, Midwest Refining Co.

Walters, Charles W. 1911 E.M.
Information requested.

Walz, Clarence M. 1921 E.M. (Geol.)
965 18th Ave. S. E., Minneapolis.
Western Wheel & Rim Co.

Warren, Frank M. 1899 E.M.
3427 Humboldt Ave. S., Minneapolis.
Consulting engineer for Pine Land Co. and other companies in development and inspection of iron ore properties on the Mesabi and Vermillion Iron Ranges.

Wasson, Harold J. 1914 E.M.
6115 Kimbark Ave., Chicago, Ill.
Geol. and Engr., New England Oil Corp., Ltd., in Venezuela.

Wehr, Arthur J. 1911 E.M.
Fort Riley, Kansas.
Captain, U. S. Army.

Wenger, Frank B. 1921 Met.
718 Baldwin St. S. E., Grand Rapids, Mich.
Engr. for Potts Exploration Co. and Northern Minnesota Ore Co., Durwood, Minn.

West, Herbert S. 1921 Met.
Dept. of Public Works, City of St. Paul.
Civil Engr., Dept. of Public Wks.

Wheeler, James O., 1920 E.M. (Geol.)
Caix Postal 315, Loanda, Angola, Portuguese West Africa.
U. S. address: Care Sinclair Exploration Co., 45 Nassau St., N.Y.C.
Field Geol., Companhia de Petroleo de Angola.

Wheeler, Walter H. 1906 E.M.
1110 Metropolitan Life Bldg., Minneapolis, Minn.
Special Engr. for Hennepin County Location, design and construction of Mendota bridge.

Whitley, Eugene E. 1903 E.M.
Box 705, Warren, Ariz.
Supt. of Mines, Calumet & Arizona Mining Co.

Whitson, Lloyd R. 1911 E.M.
1009 Southwestern Life Bldg., Dallas, Tex.

Wiest, Michael A. 1907 E.M.
311 Phoenix Bldg., Minneapolis.
Dist. Mgr., the Mutual Life Ins. Co. of New York, 311 Phoenix Bldg., Minneapolis, Minn.

Wilcox, Fred H., (1923 E.M. (Geol.)
2117 Kenwood Pkwy., Minneapolis.
Geology Dept., N. P. Ry.

Wilkinson, Charles D. 1895 E.M.
Goldfield, Nev.
Mgr.-Cons. Engr., Diamondfield Black Butte Reorganized Mining Co., Goldfield, Nev.

Williams, Homer A. 1909 E.M.
883 Lakeview Ave., St. Paul, Minn.
Valuation Engr. with D. F. Wilcox Co., Grand Rapids, Mich., on Minneapolis Gas Light Co. property.

Williams, Paul S. 1915 E.M.
Information requested.

Wilson, J. Byron 1922 E.M.
320 4th St. N. E., Minneapolis.

Winter, William Morse 1923 E.M.
Olivia, Minn.
Junior Engr. for Kircher Bros.

Winther, Arno 1903 E.M.
Comstock, Nev.
Mgr., United Comstock Mines Co.

Wolfer, Donald H., 1923 E.M. (Geol.)
Kevin, Mont.

Woodis, Clark N. 1912 E.M.
Deer Trail, Colo.
Ranching.

Woodruff, John J. 1917 E.M.
Information requested.

Wrbitzky, Harry M. 1923 E.M.
Illinois Highway Dept., Peoria, Ill.
Junior highway Engr.

Zanger, Eugene D. 1921 E.M.
3120 Humboldt Ave. S., Minneapolis.
With New York & Honduras Rosario Mining Co., San Juancito, Honduras, C. A.

Ziesemer, Harry M. 1907 E.M.
Box 394, Bisbee, Ariz.
Chief engineer, Phelps-Dodge Corporation, Copper Queen Branch, Bisbee, Ariz.

Ziesemer, Ralph A. 1905 E.M.
Box 394, Bisbee, Ariz.
Member of firm of Smith & Ziesemer, Bisbee, Ariz.

Former members who are following mining work:

Brown, Walter M. 1900
535 E. Dayman St., Long Beach, Cal.
President the Walter M. Brown Engineering Co., consulting mining engineer.

Callaway, Frederick W. 1900
Kellogg, Idaho.
Private consulting practice.

Cohen, Julius M. 1912
Dominion Express Bldg., Montreal, Can.
Consulting and examining engineer.

Davenport, Lee B. 1900
Mokelumne Hill, Calaveras Co., Cal.
Mgr. of the Phoenix Hill Mining Co.

Davy, Jesse J. 1908
(Permanent address) Preston, Minn.
Road and bridge contractor.

Donovson, Percy W. 1901 E.M.
710 Security Bldg., Minneapolis.
Mgr., contract drilling dept., E. J. Longyear Co.

Ekstrom, Alex J. 1913
Bennett Mine, Keewatin, Minn.
Mining engineer.

Hezzelwood, George W. 1923
Eureka, Utah.
Chief Consolidated Mining Co., Eureka, Utah.

Jewett, Frank G. 1900
740 McKnight Bldg., Minneapolis.
Private professional work; also manager the Greenwood Co.

Lawton, John E. 1911
5304 Russell Ave: office address, Room 209, City Hall, Minneapolis.
Asst. engr., sewer department.

McCormack, Clyde P. 1912
406-409 Perry-Payne Bldg., Cleveland, Ohio.
Consulting mining engineer, Crowell & Murray of Cleveland.

Ober, Raymond E. 1902
Ironton, Minn.
Private practice.

Reinholt, Oscar H. 1902
4775 Hamilton St., San Diego, Cal., and 5046 Interior Bldg., Washington, D. C.
Treasury Dept., Washington, D. C.

Searles, Jasper E. 1899
Felt Bldg., Salt Lake City, Utah.
President J. E. Searles Eng. Co.

Sundeen, Ludvig J. 1923 E.M.
care of American Smelting & Refining Co., Garfield, Utah.
With American Smelting & Refining Co.

Sundness, Odin A. 1910
Chisholm, Minn.
Chief engineer and chemist, Shenango Furnace Co.

Van Cleve, Reginald H.
Casson Lake, Minn.
Captain, Leetonia Mine, Casson Lake, Minn.

Williams, James H. 1911
Nashwauk, Minn.
Asst. Gen. Supt., Wisconsin Steel Co.

Willis, Carl S. 1903
Glacier, Wash.
General manager, Brooks, Willis Metals, Inc., operating the Lone Jack Mines and Red Mt. Rose Mine, Glacier, Wash.; also general manager Brooks, Willis Metals, Ltd. (Canadian), operating at Jervis Inlet, B. C., and general manager, Brooks, Willis Engineer Co., manufacturing the B. C. and Washington "Giant" Pulverizing and Classifying Mill.

CONSIDERATE

Lawyer—"What? Ten thousand a year to your wife if she marries again, and only five thousand if she doesn't? That is unusual!"

Client—"Yes, but, you see, I think of my successor. He deserves extra!"—The Passing Show (London).

INDUSTRIAL LIGHTING CODES.

In order to protect workers from accidents and eye sight damage, no less than five states, New York, New Jersey, Pennsylvania, Wisconsin and Oregon have now in force lighting codes for industrial establishments. Other states are now considering the adoption of an industrial lighting code, and it seems only a question of time when all the states will adopt such a code.

Proper lighting of work places is not only of great importance to the operators working therein, directly affecting their safety and eyesight, but it is a factor of equal importance to the employer, as quality and quantity of output are deciding factors of profit or loss in the operation of the plant.

The introduction to the Wisconsin code reads as follows: "Insufficient and improperly applied illumination is a prolific cause of industrial accidents. In the past few years numerous investigators, studying the cause of accidents, have found that the accident rate in plants with poor lighting is higher than similar plants which are well illuminated. Factories which have installed approved lighting have experienced reductions in their accidents which are very gratifying.

"Of even greater importance, poor lighting impairs vision. Because diminution of eyesight from this cause is gradual, it may take the individual years to become aware of it.

"This makes it all the more important to guard against the insidious effects of dim illumination, of glaring light sources shining in the eyes, of flickering light, of sharp shadows, of glare reflected from polished parts of work. To conserve the eyesight of the working class is a distinct economic gain to the state, but regardless of that, humanitarian considerations demand it.

"Finally, inadequate illumination decreases the production of the industries of the state, and to that extent, the wealth of its people. Factory managers who have installed improved illumination, are unanimous in the conviction that better lighting increases production and decreases spoilage."

The Wisconsin Commission has adopted a rule to the effect that, "diffusive or refractive window glass shall be used for the purpose of improving day light conditions or for the avoidance of eye strain, wherever the location of the work is such that the worker must face large window areas, through which excessively bright light may at times enter the building."

A glass is now available which meets the above requirements. It properly diffuses the light and prevents sun glare passing into the building and is known as Factrolite.

Engineers of to-day are making a thorough study of illumination, so that they may be able to plan and lay out industrial plants, to scientifically increase their efficiency to as near the maximum as possible. This accomplished the engineer is not only doing something worth while for his employer, but is doing quite as much for himself by coming into prominence with modern ideas.

If you are interested in the distribution of light through Factrolite, we will send you a copy of Laboratory Report—"Factrolited."

MISSISSIPPI WIRE GLASS CO.,
220 Fifth Avenue,
St. Louis. New York. Chicago.